MONTHLY WEATHER REVIEW,

MAY, 1879.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the present REVIEW the following data, received up to June 14th, have been made use of, viz: The regular tri-daily weather charts, containing the data of simultaneous observations taken at 122 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means, 131 and 149 respectively, from the former, and monthly means from 13 of the latter; reports from 28 special Sunset stations; 225 monthly registers from Voluntary Observers; 49 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of, the States of Iowa and Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to sea-level, for the month. Compared with the means for May of previous years, the mean pressure for the present month is higher in all the districts, except Florida, from southern Alabama to Texas, in the Missouri valley from Yankton to Leavenworth, and at Salt Lake City and Portland, Or.; but in these districts it agrees with the average or is very slightly below, the greatest deficiency (0.03 inch) occurring at Punta Rassa. The regions of greatest excess are in the Northwest (Bismarck 0.26 above,) in California, (Sacramento 0.14 above,) and over New England, the Middle Atlantic States and Lower Lakes, (Mt. Washington 0.14 and Albany 0.12.) In the remaining districts it ranges above the average as follows: South Atlantic States, 0.08 at Cape Hatteras to 0.00 at Jacksonville; Ohio valley and Tennessee, 0.09 at Pittsburg to 0.02 at Memphis; Upper Lakes, 0.10 at Escanaba to 0.05 at Milwaukee; Upper Mississippi valley and Minnesota, 0.10 at Pembina to 0.02 at Keokuk; Rocky Mountain stations, 0.09 at Santa Fé to 0.01 at Virginia City. In the following description of areas of high and low pressure, the barometer readings when given are as reduced to sea level, but the deviations from normal relate to pressures not reduced.

The Local Barometric Ranges have been comparatively small, and have varied as follows: California, 0.37 at San Diego and San Francisco to 0.57 at Red Bluff; Western Plateau, 0.36 at Pioche to 0.62 at Boise City; Rocky Mountains, 0.32 at La Mesilla, N. M., to 0.78 at Virginia City; Gulf States, 0.25 at Key West and 0.40 at Galveston to 0.59 at Graham, Tex., and 0.60 at Montgomery; Atlantic States, 0.55 at Jacksonville to 0.64 at Norfolk, 0.83 at Wood's Holl and 1.00 at Eastport, and in interior, 0.64 at Augusta to 0.74 at Lynchburg and 0.93 at Albany; Ohio valley and Tennessee, 0.52 at Memphis to 0.82 at Pittsburg; Lake region, 0.88 at Cleveland to 1.19 at Duluth; the Northwest and Eastern Slope of Rocky Mountains, 0.79 at St. Louis to 1.33 at Breckenridge, 0.87 at Leavenworth to 1.11 at Yankton and 0.94 at Bismarck, 0.99 at Dodge City, 1.05 at North Platte and 0.79 at Deadwood.

Areas of High Barometer.—Nine are described below. The average directions of the paths of highest pressure is from the Pacific coast, between latitudes 38° and 45°. northeastward to Manitoba and thence east-southeastward to the Atlantic coast.

No. I—was central on the morning of the 18th over Minnesota, and moved southeastward over the eastern section of the country during the 2nd and 3rd. It produced the lowest temperatures of the month in the Lake region, Ohio valley, Gulf and Atlantic States, and killing frosts in the low lands of some of the Southern States. The following minimum temperatures were observed: on the 1st, at Port Huron, 27°; Oswego, 30°; on the 2nd, Pittsburgh, 33°; Knoxville, 38°; on the 3rd, Montgomery, 50°; Atlanta, 49°; Augusta, 48°; Charlotte and Kittyhawk, 45°; Washington and Albany, 36°.

No. II—appeared on the 2nd on the Pacific coast in rear and to the southwest of low pressure area No. II; 4:35 p. m. barometer at Red Bluff 30.23, or 0.32 above the normal; fresh to high northwesterly winds, rapidly falling temperature and clear weather extended eastward to Utah. Maximum velocities: at Winnemucca, W. 46; Salt Lake City, NW. 48; Umatilla, SW. 48 miles. 3rd, was central over the Western Plateau; pressure at 7:35 a. m. (Washington time) 0.20 above normal at Umatilla, Boise City and Salt Lake; minimum temperatures, 23° at Winnemucca, 30° at Boise City, 32° at Pioche and 25° at Virginia City, Mon. 4th, central over Montana, with diminished pressure; minimum temperature at Virginia City, 28°; summit of Pike's Peak, 10°. 5th, central over Dakota, with increasing pressure, and preceded by north to west winds and falling temperature to the Ohio valley and Lower Lakes. 6th, central over Manitoba, with increased pressure; the lowest temperatures of the month occurred in the Upper Mississippi valley, with heavy frosts, and cooler northwesterly winds extended over the Middle States. 7th to 9th, moved slowly eastward over the Lake region, with heavy frosts, and New England; light to fresh north winds veering to easterly and clear weather prevailed east of the Rocky Mountains, except over the Northwest, where southerly winds and light rains preceded low areas Nos. IV and V, and along the South Atlantic States, where fresh to high northeast winds and cloudy or rainy weather generally prevailed. Cautionary Signals (late) ordered on the North Carolina coast morning of the 7th were justified: Cape Lookout, NE. 40 miles. Cautionary Signals (late) ordered on the North Carolina coast on the morning of the 8th and continued to the afternoon of the 11th were fully justified: Cape Lookout, NE. 40 miles; Kittyhawk, NE. 45. On the 11th there was probably an area of low pressure east of Florida; at Punta Rassa the wind rose to NW. 42. 10th to 14th, the highest pressure continued off the southern New England and Middle Atlantic coasts, with continued northeasterly winds, cloudy and rainy weather in the South Atlantic States; east to southerly winds, clear or fair weather and rising temperature in the Middle States and New England.

No. III—appeared on the coast of California on the 6th in rear and to the southwest of low area No. IV, and passed northwards on the 7th, followed during the night and morning of the 6th and 7th by cold northerly winds from California to Idaho; during the prevalence of which heavy frosts occurred doing considerable damage in the low valleys of central and northern California; in the Honey Lake valley, Cal. and Nevada, "the prospects for a good fruit crop were completely destroyed."

No. IV—appeared on the Pacific coast on the 9th and remained almost stationary until the 11th, with generally cool, clear weather west of the Rocky Mountains, except occasional very light rains in Oregon, Washington Ty. and southern portion of Nevada. 12th, it spread eastward, in rear of low area No. X, preceded by diminishing brisk to high northerly winds and clearing weather in eastern Wyoming and Colorado, and followed by rising temperature over the Western Plateau and interior of the Coast States. 13th, was central over Montana, with clearing weather over the extreme Northwest. 14th, central over the Northwest with diminished pressure. 15th and 16th, moved eastward over the Lake region with clear, pleasant weather; heavy frost was reported in La Crosse Co., Wis.

No. V—appeared on the coast of California on the 14th as low area No. VI moved eastward into Utah and Montana. 15th, moved northeast to Idaho, preceded by brisk to high westerly winds and clearing weather. 16th and morning of the 17th was central over Idaho and Montana, with low temperatures and frosts in the Upper Missouri valley. 17th and 18th passed rapidly eastward north of the Lake region and St. Lawrence valley, with clear or fair weather in these districts. Brisk to high northerly winds prevailed for a short time on the 17th on Lake Superior and Cautionary Signals were ordered for Lake Michigan and Port Huron, but were not justified.

No. VI—appeared over the Northwest on the 20th in rear of low area No. VIII and moved slowly eastward to the Gulf of St. Lawrence by the 23rd. During these days clear or fair weather and northerly, veering to easterly, winds generally prevailed east of the Rocky Mountains, with frosts in the Lake region, New England and Middle States, while low area No. X approached the Northwest from the Pacific. 24th, it moved southward over the Atlantic States, with winds veering from east to south in the Atlantic and Gulf States as low area No. X moved eastward over the Lake region; at Cape May the minimum temperature was 47°, but ice was reported within five miles of station; frosts occurred southward to Virginia.

No. VII.—On the 22nd a general rise in pressure occurred on the Pacific coast, in rear of low area No. X. 23rd, the pressure fell over California but rose to the northward and over the Western Plateau. 24th and 25th, highest pressure was over Idaho, Montana and Wyoming. 26th, over the Northwest. 27th and 28th, over the Mississippi valley and Lake region. 29th and 30th, off the Atlantic coast, followed by southerly winds and rising temperature.

No. VIII—appeared north of Lake Superior on the 25th. 26th, moved southeastward over the Lake region and Middle States; lowest temperature of month, 13°, on summit of Mt. Washington. 27th, moved southward off the Atlantic coast and joined area No. VII; on this day the maximum velocity of the month, NW. 133 miles, occurred on summit of Mt. Washington.

No. IX.—As low area No. XIII moved northward on the 28th the pressure rose over southern California, reaching the maximum (30.26 or 0.30 above normal) at San Diego at 4.35 p. m. (Washington time); snow fell on the Sierra Nevadas and "the snow line extended well down to the foot hills on the Nevada side. 29th, the highest pressure was transfered to Oregon; maximum (30.34) at Portland at 11 p. m. 30th, it moved eastward and on the 31st was central over Montana and Dakota; barometers, at 11 p. m., at Virginia City and Bismarck, 30.04 or 0.37 and 30.38 or 0.45 above normals, respectfully.

Areas of Low Barometer.—Fifteen have been sufficiently well marked to merit a brief description, and upon chart No. II will be found the tracks of the centres of fourteen. The general direction of the most important has been easterly.

No. I—is a continuation of low areas No. XVI and XVII, described in the *April Review*. 1st, it moved slowly northeastward to the mouth of the St. Lawrence, with cloudy or rainy weather from Cape Breton to Lake Ontario, and snow in the Province of Ontario. During this day a secondary depression remained over the South Atlantic States, with cloudy and rainy weather. 2nd, clearing weather and southwesterly winds in the Canadian Maritime Provinces, reaching a velocity of 35 miles at Father Point.

No. II—was probably central over British Columbia on the 1st; light rains fell in Wash. Ty. and Oregon. 2nd, central over Montana; barometer at 4.35 p. m. at Virginia City, 29.19, or 0.39 below normal; high westerly and northwesterly winds and gales accompanied the rising pressure along the western slope of the Rocky Mountains from the interior of Washington Territory to Utah, and brisk to high southerly winds and gales, with falling pressure, along the eastern slope from Kansas to Minnesota and Dakota. 3rd, moved southeastward to the Upper Mississippi valley; cloudy and rainy weather extended to the Ohio valley and Lower Lakes; winds veered to brisk and high northerly along the eastern slope; Cheyenne, NW. 43; Ft. Stevenson, W. 50; a light thunderstorm occurred at midnight in central Texas. 4th, centre moved to Lake Michigan, where the winds increased to high westerly; cloudy and rainy weather extended to the interior of the Gulf States and Atlantic coast from North Carolina to Maine; clearing weather during latter part of day from the Ohio valley and Lake Erie westward, with brisk and occasionally high westerly winds. 5th, centre moved to the St. Lawrence valley; rain extended over the Canadian Maritime Provinces and clearing weather, with brisk westerly winds, prevailed in the Lake region, except continued snow or rain in northern Michigan. 6th, central over Maine, with diminished energy and fine weather, except fogs or light rains along the Canadian coasts, St. Lawrence and Richelieu or Sorel valleys. 7th, moved northeastward over the Gulf of St. Lawrence, with heavy rain, followed by clear weather, in New Brunswick. Cautionary Signals ordered on the 3rd at Duluth, Escanaba, Milwaukee and Grand Haven, and on the Atlantic coast from Smithville to Sandy Hook, and on the morning of the 4th from Alpena to Buffalo were very generally justified, except on the New Jersey coast. The following maximum velocities were registered: Duluth, N. 32 miles per hour: Milwaukee, W. 40; Grand Haven, W. 36; Erie, W. 30; Wilmington, SW. 27, and Kittyhawk, SW. 32. Cautionary Off-shore Signals ordered up at midnight of the 5th, were not justified.

No. III—developed over Texas on the 4th, and on the 5th and 6th moved down the Rio Grande valley, with fine weather near the centre, but with heavy thunder and hail storms in the West Gulf States. Cautionary Off-shore Signals ordered at Indianola and Galveston on the afternoon of the 5th were justified:—Indianola, N. 34; Galveston, N. 42; Concho, Tex., NE. 40 miles.

No. IV.—After the passage eastward of high area No. II on the 3rd, fresh to brisk southerly winds, with rising temperature and falling barometer, prevailed over the Western Plateau until the morning of the 6th, when the pressure reached 29.67 or 0.35 below the normal at Olympia, Or.; during the day the centre moved eastward to Montana, followed by a westerly gale, hail and rain in the Columbia valley. 7th, it passed northward into British America. Maximum velocities: Red Bluff, SE. 40; Umatilla, W. 48.

No. V.—The preceding area was followed over the Pacific States and Western Plateau by high area No. III. On the afternoon of the 9th the pressure was below normal from Nevada to Montana, with westerly winds, to Dakota and Kansas, over which latter region south to east winds prevailed. 10th, lowest pressures over Utah and Nebraska with light rains in Montana. 11th, lowest pressure central over Nebraska, with brisk to high southerly winds and fine weather from Texas to Kansas and Iowa; Fort Sill, SE. 39; northeasterly winds and rain from northern Michigan to Dakota, and, during latter part of day, brisk to high northerly winds and gales, with heavy rains, from southern Dakota to Colorado; Denver, N. 60; Fort Craig, N. M., W. 42. 12th, central over Nebraska and Kansas; the general condition remained about the same as the preceding day, except that the northerly winds extended to the interior of Texas and the weather cleared from Dakota to Colorado; on this day the maximum wind velocity of the month, NE. 108 miles, occurred on the summit of Pike's Peak during a blinding snow storm—this is the highest velocity registered since opening of the station, the next below (102 miles) occurred in December 1875; North Platte, N. 60. 13th, central over Iowa and Missouri; light rains or thunder showers extended to the interior of the Gulf States, Ohio valley and Lake Erie, and northerly winds with heavy local rains to northern Missouri. 14th, central depression formed an elongated trough from Missouri to Lake Ontario; cloudy or rainy weather, with northerly winds, from Missouri and Iowa to Ontario, and with easterly winds over eastern Tennessee and northern Georgia. Cautionary Signals ordered for the Lower Lakes on the morning of this day were not justified. 15th, depression divided into two centres, the northern one remaining over Lake Ontario and the southern one moving toward the Gulf States; thunderstorms from Indiana to Tennessee and interior of North Carolina; continued rain in the Lower Lake region and light rains in the Atlantic States by night. From the 16th to the 19th the lowest pressure remained south of the Ohio valley with a gradual tendency toward the northeast along the western slope of the Alleghanies; on the afternoon of the 17th a heavy thunderstorm prevailed from Georgia to North Carolina, and on the 18th and 19th heavy rains along the immediate coast from North Carolina to Long Island and in Maryland; otherwise it was only attended by ordinary rains, and on the 19th was dissipated while central over West Virginia. The northern depression

over the Lower Lakes moved down the St. Lawrence valley on the 16th, with southerly winds and light rains over New England and Middle Atlantic States; a heavy thunderstorm occurred over Maryland; Wood's Holl, SE. 40.

No. VI.—The pressure fell over northern California and Oregon on the 13th, as high area No. IV moved into Montana, and cloudy and rainy weather, with brisk winds, extended to Idaho. 14th, lowest pressure moved into Montana, brisk west to south winds and clearing weather in northern California, Nevada and Utah, but continued light rains in the Columbia and Snake river valleys. 15th, moved towards Manitoba; brisk to high westerly winds at Umatilla, Or., and in Montana, and brisk to high southerly winds from Kansas to Dakota. 16th, disappeared to the north of Lake Superior.

No. VII.—In rear of the preceding area, high area No. V moved northeastward over the Pacific States. 16th, the pressure fell below the normal over northern California, Oregon and Nevada. 17th, depression moved northward, with rain along the coast, and cloudy or threatening weather, with fresh to brisk winds, over the Western Plateau and in western Montana accompanying the formation of a secondary de-, pression, described as area No. VIII, over southern Idaho and northern Utah. 18th and 19th, the lowest pressure probably passed to the northward, but cloudy or partly cloudy weather, with numerous rains and fresh to brisk winds continued during these days over the Pacific States and Western Plateau.

No. VIII—developed on the afternoon of the 17th as stated above. 18th, was central over Wyoming preceded by south to east winds and light rains (increasing to heavy in northern Dakota) in the Missouri valley and Black Hill region. 19th, depression divided into two centres, the northern one moving to Lake Superior, with fresh to brisk winds, partly cloudy weather and light rains in the Northwest; the southern one, moving southward over the Eastern Slope, will be considered as area No. IX; a heavy thunder-storm occurred at North Platte from 8:15 to 9:30 p. m. 20th, moved eastward north of the Lake region, with clear or fair weather, followed by brisk westerly winds in that district. 21st, it passed rapidly eastward over the Gulf of St. Lawrence, with light rains and brisk winds thence to New England. Cautionary Signals ordered up on the Upper Lakes at midnight of the 19th; on the Lower Lakes and along the east coast of New England on the afternoon of the 20th; from Newport to Baltimore on the morning and thence to Smithville on the afternoon of the 21st were justified, except on the Lower Lakes from Erie to Oswego and along the New England coast at Eastport and Portland. Signals were changed to Off-shore on the afternoon and midnight of the 21st from Eastport to Baltimore, in advance of high area No. VI, and were justified along the New Jersey coast. Maximum velocities: Escanaba, N. 29 miles; Port Huron, N. 32; Sandusky, N. 35; Wood's Holl, W. 26; Sandy Hook, NE. 30; Norfolk, NW. 34, and Cape Hatteras and Macon, NE. 36.

No. IX—was an ill-defined depression, which separated from the preceding area and moved southward to the Gulf of Mexico during the 20th and 21st; it was accompanied over the Southwest by the highest temperatures of the month: Concho and McKavett, 107°, Uvalde and Castroville, 108°, and Brackettville, 109°. Cautionary Signals were ordered at Indianola (late) and Galveston on the afternoon of the 20th, but were not justified. Maximum velocities: Indianola, (before signal,) S. 28; New Orleans, afternoon of the 22nd, E. 30.

No. X—began to develop slowly over the Sacramento valley and northern Nevada during the night of the 20th. 21st, moved slowly eastward to southern Idaho, with brisk to high winds and occasional light rains. Terrific and destructive hail-storms occurred during the afternoon at Salem and near Sandy, Oregon; at Salem it "commenced about 6 p. m., lasted over thirty minutes, hail fell to a depth of two inches, all skylights were demolished; it was not accompanied by high winds and was apparently confined to a narrow belt." The storm between Sandy and Mount Tabor lasted about the same time, "covered the road to the depth of nine inches with hail-stones, and must have done great damage to orchards:" Pioche, S. 38; Salt Lake City, 4:35 p. m., barometer 29.68, or 0.20 below normal, SE. 17 miles, threatening. 22nd, over Montana, preceded by brisk to high southeast winds and thunder-storms in the Upper Missouri and Red River of the North valleys. 23rd, over Dakota and Minnesota, with local rains and brisk to high winds. 24th, over Upper Lakes, with brisk to high winds. 25th and 26th, over Lower Canada. Cautionary Signals ordered for the Lake region, at Duluth, on the midnight of the 22nd, from Marquette to Sandusky afternoon of the 23rd, and thence to Buffalo afternoon of the 24th were only justified on Lake Michigan during passage of present area: Grand Haven, SW. 28 and Milwaukee, SW. 30; but were subsequently justified by high winds attending area No. XI. Cautionary Signals ordered on the afternoon of the 25th from Macon, N. C., to Boston, and at midnight at Portland, changed to Off-shore morning of the 26th on coast of New England, were justified, except at Norfolk and Cape Henry. Maximum velocities: Cape Lookout, SW. 32; Cape May, NW. 28; Sandy Hook, SE. 32; Boston, NW. 28.

No. XI—developed over Kansas and Nebraska on the 23rd and 24th, in southwest quadrant of preceding area. 25th, central over Iowa, followed by gale at North Platte, NW. 60 miles. 26th, central over Illinois; on these days high area No. VIII moved southeastward over the Lake region; this produced a steep barometric gradient, with a large range of temperature and heavy rains or thunder-showers, from Wisconsin to Indiana; during the latter part of the 26th, the pressure increased and storm diminished in energy. 27th, passed northeast over the Lower Lake region with light rains thence to New England. Cautionary Signals ordered on the Lakes in advance of preceding area were continued and fully justified. Maximum

velocities: Duluth, NE. 34; Escanaba, N. 33; Milwaukee, NE. 34; Port Huron, N. 30; Sandusky, E. 36 and Oswego, NE. 28.

No. XII—appeared on the coast of Oregon on the afternoon of the 25th in rear of high area No. VII; 4:35 p. m., barometer at Roseburg 29.80 or 0.24 below normal and at 11 p. m. light rain had commenced falling. 26th, lowest pressure over Wash. Ty.; Olympia, 4:35 p. m., 29.67 or 0.34 below normal, after which centre passed northward, clearing weather by night at Roseburg, increasing rain at Portland and Olympia. 27th, southerly winds, with rain continued during the early morning at Portland and Olympia, but changed to northerly with temporary clearing weather as the following depression developed to the southward.

No. XIII—developed over northern California and southern Oregon on the 27th; cloudy, threatening and rainy weather from the coast to Utah; thunder-storm at Winnemucca, Nev. On this day a depression began to develop in the Missouri valley, which will be considered as area No. XIV, as the present area disappeared, probably to the northward, and high area No. X appeared on the coast of California.

No. XIV.—27th, falling pressure in the Missuri valley. 28th, central over southern Dakota; 11 p. m., lowest pressure, 29.56, or 0.38 below normal, at Bismarck; southeast to northeast winds and light rain from Wisconsin to Dakota; brisk to high southerly winds and high temperatures southward. 29th, central over Minnesota, with increasing rains and thunder-showers, with hail, at places southward to Missouri, and followed by colder northwest winds southward to Nebraska. 30th, it moved east northeastward over Canada; high temperatures prevailed throughout the Gulf and Atlantic States, and in Ontario, Can., several cases of sunstroke were reported. Cautionary Signals ordered for Lakes Superior and Michigan on the 28th, on Lakes Huron and Erie afternoon of the 29th, and Lake Ontario afternoon of the 30th were justiffed, except at Duluth, Buffalo, Rochester and Oswego. Maximum velocities, Marquette, SW. 36; Milwaukee, W. 40; Alpena, SW. 31; Port Huron, SW. 33; Sandusky, SW. 36; Cleveland, S. 36; Columbus, O., S. 36.

No. XV—developed during latter part of 29th and morning of the 30th over the high lands of northwestern Texas. 30th, 4:35 p. m., (Washington time) brisk southerly winds over Texas increasing to high over Indian Territory, with a general temperature of from 90° to 100°; easterly winds and threatening weather in the Lower Missouri valley; northerly winds over western Nebraska and Kansas, increasing to NW. 44 miles at Dodge City, and of a temperature ranging from 60° to 72°. Snow fell on the mountains around Denver and Santa Fe, and by morning of the 31st the thermometer fell to 10° on summit of Pike's Peak. From 4 to 10 p. m. several tornadoes swept over portions of eastern Kansas, southeastern Nebraska and northern and western Missouri, brief notice of which will be found under the head of *Local Storms*. The general direction of these tornadoes appears to have been uniformly northeastward, corresponding with that of the centre of depression, Along the immediate northern margin of this track very heavy rain fell during the night of the 30th. 31st, centre of depression increased in area with rising pressure and decreasing energy, and by 4:35 p. m. formed an elongated trough extending from Arkansas and Missouri to southern Michigan, attended by cool and brisk northerly winds over the Upper Lakes, Northwest and Eastern slope and by southerly winds from the Ohio valley and Lower Lakes south and eastward. Throughout the day cloudy and rainy weather, with occasional heavy thunder-storms, prevailed from the Southwest to Tennessee, the Lake region and Iowa. Cautionary Signals ordered up in advance of preceding area were continued. Maximum velocities, Detroit, S. 36; Dodge City, NW. 56; Cautionary Signals ordered for Indianola and Galveston on the afternoon of the 29th were justified; Indianola, midnight of 31st, NE. 39.

INTERNATIONAL METEOROLOGY.

The extra chart distributed with the present *Monthly Review*, is based on the daily charts published with the *Bulletin of International Simultaneous Observations* for *October*, 1877. It has been prepared in accordance with especial instructions from the Chief Signal Officer, and shows the average pressure at sea level, the temperature and prevailing winds for *October*, 1877, at 7:35 a. m., Washington time as given by the simultaneous observations reported to this Office.

On chart No. IV are shown the probable tracks of storm-centres over the oceans, deduced from data received at this office up to June 2nd, and in the upper right-hand corner will be found an index to the same. In the upper left-hand corner is a small table giving the approximate wind direction and probable maximum velocities (in miles per hour and meters per second) attending the depressions on the dates named. The following is a brief notice of the same, and also of some storms over the Southern Hemisphere:

North Atlantic Ocean.—No. I is a continuation of area of low barometer No. IV of the *April Review;* it passed over Newfoundland during the latter part of the 4th; on the 5th, strong SW. gales (veering on the 6th to NW.) and very high seas were experienced about 46° N., 40° W; 6th, SW. and NW. strong gales and high seas extended eastward to 30° W., and rapidly falling pressure was reported on the coast of Ireland; on the 7th, this depression probably joined area No. X of the *April Review.* No. II appeared on the 7th to the southeast of Newfoundland, and during the night developed into a very severe storm, with winds of hurricane force, about 45° N., 40° W. No. III is a continuation of low area No. VI of the *April Review;* it passed eastward north of Newfoundland on the 9th and 10th, and probably followed the

track shown on the chart; on the 12th, it was accompanied by heavy rains and south east winds from 30° to 15° W., and followed by hard NW. gales about 30° W; 13th to 17th, it moved from the Bay of Biscay to the Baltic. No. IV is a continuation of low area No. VII of the *April Review*. This track is very doubtful from the 12th to 16th, and the storm that was experienced in mid-ocean on the 17th may have been due to a new depression; 18th, very heavy NW. gales prevailed about 45° N., 40° W., which extended eastward on the 19th to 20° W., as the centre approached the Irish coast where it was preceded by severe SE. gales. No. V developed over the western Mediterranean on the 15th and 16th, in the south quadrant of area No. III, with the centre of which depression it apparantly united on the 18th. No. VI is a continuation of low area No. X of the *April Review;* it passed eastward between the Bermudas and Nova Scotia on the 19th; 20th and 21st, it was accompanied by strong gales and heavy rain and squalls, and on the 22nd and 23rd passed over the British Isles. No. VII is a continuation of low area No. XIV noticed in the *April Review;* it apparantly developed off the coast of Nova Scotia on the 23rd and moved very slowly eastward as a very severe storm, with hurricane winds and very high seas, on the 24th, 25th and 26th; 27th it rapidly decreased in energy and probably moved northward. *South Atlantic Ocean.*—On *Fedruary* 27th, a very severe storm was probably central about 50° S., 50° W., and moving southeastward; at Montevideo, the lowest pressure of the week occurred on the 24th, with rain and brisk to strong winds. *April* 8th, 27° S., 29° W., heavy squalls, thunder, lightning and heavy rain for 16 hours. *North Pacific Ocean.*—No. I is possibly a continuation of storm-centre No. II, chart IV, *March Review;* it was experienced on *February* 4th and 5th, 1879, as a SSE. to SW. gale in lat. 32° N., barometer 29.65. No. II, February 9th barometric depression (29.85.) with SSE. to NW. winds and rough sea. No. III, February 25th, depression (29.60.) with SE. to SW. winds, showers, and confused sea. No. IV, possibly a continuation of storm-centre No. I, chart IV, *April Review;* it was encountered from March 1st to 4th, as an extensive depression, from (barometer 29.58.) long, 176° W. to 168° E., about lat., 38° N., preceded by SE. strong winds and heavy rain and followed by northerly gales, hail, sleet and high seas; and on March 9th, a "very heavy gale from SSW., with high seas," was experienced in 37° N., 149° W. No. V probably shows somewhat correctly the track of a storm from March 15th to 22nd; it was accompanied from the 16th to 18th by NE'ly gales in the Straits of Formosa and on the 21st the barometer at Yokohoma fell to 29.59. No. VI, March 29th and 30th, SW. gales at Yokohoma, and S. to NW. gales in 40° N., 160° E., with heavy rains and rough seas, barometer 29.74. No. VII, *April* 1st, 43° 23′ N., 175° 08′ E., barometer 29.58, NE. strong gales, heavy rain and rough, cross, turbulent sea. No. VIII, April 4th, 45° N., 164°, 35′ W., barometer 29. 87, SW. fresh gale, considerable rain, rough sea. No. IX, from April 7th to 13th an extensive area of low pressure existed on the coast of Alaska, the barometer at Sitka showing two minima on the 9th and 11th, (29.36 and 29.38 respectively,) with calms and light rains; on the 7th and 8th, westerly gales and hail squalls prevailed in about 42° N., 140° W. *South Pacific Ocean.—February* 8th, 1879, 50° 28′ 104° 10′ W., heavy WSW. gale, heavy seas. *March 7th*, 1879, 23° 17′ S., 174° 22′ W., commenced blowing very heavy from E. by N., barometer falling; wind veered to S.; 6 p. m. barometer 28.75, hurricane. *March 16th*, 1879, 36° S., 138° W., gale from SSE., last sails, &c. *Straits of Sunda.*—Heavy westerly gales and an easterly current of four miles per hour prevailed in these Straits from *December* 7th to 31st, 1878, detaining a fleet of about 40 vessels, some of them the finest ocean clippers, to the eastward of Sumatra. *Indian Ocean.—March 20th*, 1879, Bark "Sarah Hobart" anchored outside Maurituis; had to put to sea in consequence of the approach of a hurricane. She returned on the 29th with loss of mainmast, mizzen-topmast, pump, boats, etc. Mauritius.—*March* 19th, 1879, barometer began to fall; 4:33 p. m., wind SE. by E., 24 miles; 20th, 4:33 p. m., barometer, corrected and reduced, 29.443 inches, or 747.85 mm., wind SE., 51.3 miles, overcast, squally, rain; 21st, 2:15 a. m., lowest barometer, corrected and reduced, 29.032, or 737.3; 5:30 to 6:30 a. m., greatest mean hourly velocity of wind during storm, 80.3 miles; 4:33 p. m., 29.623, or 752.40, NE. by N., 45.5 miles, wind and weather moderating.

Unalaska Island, Alaska.—Reports received from the Signal Corps Observer at Unalaska contain the following items:

Month.	Temperature.			Relative Humidity.	Rain-fall.	Days.			Wind—prevailing direction.
	Mean *	Max.	Min.			Rain or snow	Snow	Clear	
1878.									
November.....	33.5	48	21	80	3.78	19	16	1	SW. & calm.
December.....	35.1	45	19	85	10.02	24	15	2	SE.
1879.									
January.....	34.0	48	20	84	2.88	21	17	1	SW.
February.....	29.2	44	7	84	1.35	16	9	1	SE.

* ¼ (7+2+4+9+9.)

Gales, &c.—November 8th, SE. to SW. gusty gales, veering on the 9th to W. strong gale; 10th, SE. gusty gale. *December* 3rd, SE. strong gale; 13th, SE. strong gale; 21st, N. fearful gale, terrific gusts; 22nd, N. to NW. gale; 27th, SE. high gale; 28th, terrific gale increasing to storm; 29th, SW. gusty gale; 31st, SE. to E. hurricane in awful gusts, aneroid barometer read 27.84 at 4.20 p. m., having fallen 1.56 inch in nine hours, bay white with foam, rainfall, 2.31 inches; all snow on hills gone, and only heavy drifts remain, winter so far unusually mild; at this date last year 27 feet (?) of snow lay on a level. *January* 21st, 1879, SW. gale; 22nd, SW., very gusty gale; 27th, fearful gusty gale; 28th, SW. high gusty gale backing to SE. at 9 p. m.; 29th, SE. brisk to high until 3.40 p. m., then SW. hurricane, 8.30 to 11. p. m. terrific gusts rapidly succeeding each other, aneroid barometer at 4.20 p. m. 27.70, lowest reading ever recorded here; 30th, SW. terrific gale moderating. *February*, gusty gales on the 5th, 6th and 7th from SE.; and 19th, 20th and 22nd from N. NW. and W.

York Factory, Hudson's Bay, British America.—Observations taken at 7 a. m., 2 and 9 p. m., give the following means, &c.:

Month.	Barometer.			Thermometer.			Prevailing wind.	Total rain-fall.	No. of Days.			Mean relative humidity.
	Mean.	Max.	Min.	Mean. *	Max.	Min.			Rain or snow.	Snow.	Aurora	
1878—June	29.84	30.21	29.40	64.9	100.0	25.0	E.	10.50	11	1	5	70.6
July	29.71	30.19	29.17	73.3	106.0	46.0	NE.	14.80	16	0	3	64.8
August	29.82	30.08	29.40	58.9	91.0	38.0	NE.	4.90	9	0	6	82.1
September	29.88	30.33	29.44	37.1	60.0	26.0	N.	13.65	19	8	7	95;2
October	29.86	30.30	29.18	21.5	39.0	— 2.0	N., NW	2.41	19	19	11	94.6
November	29.84	30.53	29.22	17.3	35.0	—15.0	S., NW	0.32	17	17	6	92.2
December	29.97	30.40	29.15	— 6.9	29.0	—28.0	NW.	0.43	20	20	3	82.1
1879—January	30.05	30.69	29.44	—23.6	0.0	—43.0	NW.	0.15	8	8	17	76.2
February	30.00	30.58	29.22	—28.9	— 1.5	—45.0	NW.	0.61	11	11	11	71.5

* ¼ (7+2+9+9.)

June, thunder-storms, 10th, 14th, 16th, 20th, 22nd, 27th; Mirage, 1st, 2nd, 7th, 9th, 11th, 15th, 16th, 21st, 22nd, 23rd, 28th, 30th. *July*, thunder-storms, 4th, 6th, 8th, 22nd, 25th, 30th, 31st; Mirage, 9th, 14th, 19th, 21st. *August*, mirage, 1st, 9th, 11th, 17th; thunder-storms, 6th, 13th, 14th, 22nd; meteors, 10th, 11th, 12th. *December*, solar halos on 10 days; lunar halos on 11 days. *January* 30th, ice on river 4 feet 3 in. *February* 28th, ice on river 5 feet 7 inches thick.

Paramaribo, Dutch Guiana, S. A.—Observations taken at 7 a. m., 2 and 9 p. m., local time, give the following means, &c.:

Month.	Barometer.			Thermometer.			Prevailing wind.	Total monthly rain-fall.	Days on which rain fell.	Mean relative humidity.
	Mean.	Max.	Min.	Mean. *	Max.	Min.				
1878—July	29.99	30.04	29.89	80.6	88.0	75.0	E.	10.28	20	93
August	29.98	30.04	29.93	80.7	89.0	75.0	E.	8.14	21	82
September	29.96	30.01	29.87	83.5	91.0	75.0	E.	1.39	3	71
October	29.91	29.97	29.82	81.5	85.0	78.0	E.	6.13	8	78
November	29.91	29.97	29.83	82.7	92.0	74.0	E.	6.12	8	79
December	29.90	30.10	29.82	80.5	90.0	74.0	E.	10.77	20	84
1879—January	29.93	29.99	29.83	78.6	85.0	73.0	E., NE.	13.46	23	86
February	29.95	30.00	29.86	79.2	87.0	74.0	E., NE.	5.07	9	84

* ¼ (7+2+9+9.)

TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II show the general distribution of the temperature of the air for the month. By a reference to the table of average temperatures upon the same chart it will be seen that the temperature of the present month has been above the average of several years in all the districts except in Florida, Arizona, Nevada, Idaho, and the Pacific Coast States. The *minimum* temperatures of the month occurred over California on the 7th and 8th during passage of high area No. III; from the Western Plateau to the northwest from the 3rd to 7th during high area No. IV; thence to the Atlantic coast from the 1st to the 3rd during high area No. I. The *maximum* temperatures of the month occurred over California on the afternoon of the 31st; over Western Plateau on the 13th and 14th accompanying low area No. VI; Rocky Mountains on the 2nd and from the 21st to the 27th; Southwest, 19th to 21st accompanying low area No. IX; Gulf States, 17th to 28th; South Atlantic States, 25th to 31st and in the Lake region, Ohio valley, Middle States and New England from the 29th to the 31st.

Minimum and Maximum Temperatures, respectively, are for *Maine*—At Eastport, 36° and 63°; Orono, 28°, 88°. *New Hampshire*—Dunbarton, 39°, 90°; Summit of Mt. Washington, 13°, 62°. *Vermont*—Burlington, 34°, 89°; Woodstock, 26°, 91°. *Massachusetts*—Boston, 38°, 93°; Rowe, 30°, 82°. *Rhode Island*—Newport, 40°, 76°. *Connecticut*—Southington, 34°, 85°. *New York*—New York City, 40°, 86°; Schroon Lake, 26°, 94°; Albany, 36°, 89°; Buffalo, 33°, 84°. *New Jersey*—Princeton, 29°, 90°; Atco, 45°, 96°. *Pennsylvania*—Near Franklin, 26°, 88°; Pittsburgh, 35°, 93°; Philadelphia, 31°, 91°. *Delaware*—Dover, 48°, 88°. *Maryland*—Baltimore, 43°, 94°; Emmittsburg, 31°, 86°. *District of Columbia*—Washington, 36°, 94°. *Virginia*—Snowville, 27°, 86°; Norfolk, 48°, 96°. *West Virginia*—Helvetia, 28°, 88°. *North Carolina*—Murphy, 31°, 89°; Weldon, 51°, 95°; Kittyhawk, 45°, 91°. *South Carolina*—Aiken, 52°, 92°; Charleston, 55°, 88°. *Georgia*—Augusta, 48°, 91°; near Forsyth, 54°, 94°. *Florida*—Houston, 60°, 98°; Key West, 68°, 91°. *Alabama*—Green Spring, 46°, 90°; Montgomery, 50°, 96°. *Mississippi*—Near Brookhaven, 52°, 89°; Vicksburg, 55°, 94°. *Louisiana*—New Orleans, 58°, 86°; Shreveport, 61°, 92°. *Texas*—Pilot Point, 40°, 97°; Eagle Pass, 65°, 116°; Galveston, 64°, 89°. *Ohio*—Westerville, 29°, 91°; Ruggles, 40°, 95°. *Kentucky*—Louisville, 43°, 92°. *Tennessee*—Knoxville, 38°, 91°; Memphis, 50°, 96°. *Arkansas*—Mt. Ida, 44°, 88°. *Michigan*—Lansing, 25°, 91°; Ypsilanti, 25°, 90°; Alpena, 29°, 86°. *Indiana*—Spiceland, 32°, 89°. *Illinois*—Marengo, 36°, 92°; Anna, 46°, 95°. *Missouri*—Oregon, 38°, 93°; Kansas City, 40°, 93°; St. Louis, 45°, 91°. *Kansas*—Wellington, 38°, 97°; Lea enworth, 40°, 92°. *Wisconsin*—Neillsville, 26°, 86°; Embarras, 38°, 88°. *Iowa*—Logan, 26°, 88°; Fort Madison, 30°, 93°. *Nebraska*—Plattsmouth, 34°, 91°;

North Platte, 34°, 93°. *Indian Territory*—Fort Sill, 50°, 96°. *Minnesota*—Breckenridge, 28°, 81°; St. Paul, 35°, 86°. *Dakota*—Olivet, 28°, 92°; Ft. Stephenson, 29°, 75°. *Colorado*—Pike's Peak, 10°, 41°; Denver, 37°, 90°. *New Mexico*—Santa Fe, 34°, 84°, La Mesilla, 42°, 101°. *Wyoming Territory*—Ft; Fred Steele, 25°, 85°; Ft. Fetterman, 30°, 87°. *Montana*—Virginia City, 26°, 72°. *Utah*—Salt Lake City. 35°, 84°. *Nevada*—Winnemucca, 26°, 77°; Pioche, 29, 78°. *Idaho*—Boise City, 30°, 79°. *California*—Calistoga, 31°, 84°; Red Bluff, 31°, 96°; Los Angeles, 43°, 97°; Mammoth Tank, 64°, 108°; Cisco, 10°, 70°; Campo, 26°, 93°. *Oregon*—Roseburg, 34°, 82°. *Washington Territory*—Olympia, 35°, 76°. *Arizona*—Burkes, 60°, 105°; Grant, 44°, 94°.

Ranges of Temperature.—The *monthly ranges* will appear from an examination of the minima and maxima just given. The greatest *daily ranges* vary in New England from 19° at Wood's Holl to 36° at Boston; Middle Atlantic States, 22° at Cape May to 33° at Baltimore; South Atlantic States, 16° at Cape Hatteras to 29° at Wilmington and Augusta; Eastern Gulf States, 16° at Key West to 33° at St. Marks; Western Gulf States, 17° at Galveston to 47° at Uvalde; Ohio valley and Tennessee, 25° at Cairo to 38° at Pittsburgh; Lower Lake region, 28° at Erie to 39° at Sandusky; Upper Lake region, 27° at Escanaba to 38° at Chicago; Upper Mississippi valley, 29° at Davenport to 33° at St. Paul; Missouri valley, 27° at Omaha to 36° at Fort Stevenson; Red River of the North valley, 42° at Breckenridge and 40° at Pembina; Eastern Rocky Mountain slope, 27° at Denison to 47° at Uvalde and 38° at North Platte; Rocky Mountain stations, 21° at Pikes Peak, 36° at Virginia City to 48° at Fort Craig; Western Plateau, 31° at Boise City and 42° at Winnemucca; California, 19° at San Francisco to 37° at Los Angeles; Oregon, 34° at Portland and 35° at Roseburg and Olympia.

Frost, injurious to vegetation, is reported as follows: Gainesville, Ga., 3rd, killing cotton on low grounds Cornish, Me., killed brakes; 24th, killed young clover. Farmington, N. H., 27th, severe, killing all vegetation. Freehold, N. Y., 24th, injured beans. Palermo, N. Y., 23rd and 24th, severe, killing leaves on forest trees. Lenoir, N. C., 3rd, killing potato vine tops and tender grape vines. Litchfield, Ohio, 23rd, greatly damaging garden and fruit. Wytheville, Va., 3rd, 12 miles from here fruit trees badly frozen; 11th, near low grounds and water courses very severe; 31st, peach, cherry, apple, strawberry, pear destroyed in some places. Madison, Wis., 6th, injured early barley and vegetables. Grand Haven, Mich., 7th. Calistoga, Cal., 7th, killed grape vines, tomatoes, apricots; 22d, killed young orange shoots. Yreka, Cal., 27th, apple, peach, pear, cherry killed. Southington, Conn., 27th. Logan, Ia., 6th, hardest frost in May for 20 years, killed much fruit. Monticello, Ia., 6th. Dunbarton, N. H., 27.

Ground Frozen.—Rowe, Mass., 3rd, frozen, 7th, frost nearly out of ground.

Ice.—Severe frosts, causing formation of ice are reported as follows: Winnemucca, Nev., 19th, sleet; Dubuque, 6th; Detroit, 1st, 2nd; Pittsburgh, Pa., 3rd, ¼ in.; Cape May, N. J., 24th, ice formed 5 miles from station; Rowe, Mass., 6th, on pond; Clear Creek, Neb., 6th, $\frac{1}{16}$ in. thick; Waterburg, N. Y., 8th, 9th; Starkey, N. Y., 23rd, ¼ in.; Nile, N. Y., 8th, ¼ in., 22nd, 23rd, 24th, (27th, ½ in. to ¾ in.); Westerville, O., 1st, 2nd, 3rd, 8th; Norwalk, O., 1st, ½ in., 2nd, 3rd, 8th, 9th, 22nd, 23rd; Chamberburg, 3rd, 8th, 10th; Catawissa, Pa., 2nd, 3rd; Coleville, Mich, 3rd and 6th, 4 in. and 2 in. respectively; Snowville, Va., 3rd; Campo, Cal., 18th, 20th, 22th, 23th, 24th, very severe black frosts, ice ¼ in. thick, and on 22nd ½ in. thick.

PRECIPITATION.

The general distribution of the rain-fall, which includes melted snow, for the month is illustrated as accurately as possible by returns from about 650 stations upon chart No. III. In the lower left-hand corner of same will be found a table giving the average precipitation of *May* by districts. It has been below the average in all districts, except Nova Scotia, Tennessee, Minnesota and the Pacific States. Numerous cases of drought are reported, notice of which will be found under that special heading.

Special Heavy Rains.—5th, Decatur, Tex., 2.70 in., and Gatesville, Tex., 4.10 in 6 hours, with hail. 6th and 7th, Green Springs, Ala., 3.47 in. 7th, St. Augustine, Fla., 3.80 in. 11th and 12th, Cape Lookout, N. C., 2.97 in. 12th and 13th, Duluth, Minn., 2.70 in. 16th, Sandy Springs, Md., 4.28 in. 17th and 18th, Woodstock, Md., 4.35 in. 19th, Woodstock, Md. 2.00 in. in 52 minutes. 24th and 25th, Bloomfield, Wis., 3.50 in. 25th and 26th, Arlington, Ind., 4.75 in. 25th and 26th, Chicago, Ill., 2.52 in. 30th, Des Moines, 2.62 in. in 3 hrs. 3 min. 30th, Waterville, Kan., 4.00 in. 31st, Clear Creek, Neb., 3.22 in. in 25 hrs. 30 min. Numerous heavy rains occurred in connection with the local storms of the 29th, 30th and 31st.

Largest Monthly Rainfalls.—Concord, Iowa, 8.65 inches; Mesquite, Tex., 8.50 in., Duluth, Minn., 7.99 in; Cape Lookout, N. C., 7.96 in; Sandy Springs, Md., 7.97 in.; Fairfield, Iowa, 7.55 in; St. Augustine, Fla., 7.36 in.; St. Paul, Minn., 7.18 in.; Woodstock, Md., 7.00 in.; Portland, Or., 6.60 in.; Brookhaven, 6.50 in.; Vicksburg, Miss., 5.95 in.; Davenport, Iowa, 5.83 in.; Cape Hatteras, N. C., 5.75 in.; Memphis, Tenn., and Omaha, Neb., 5.53 in.; Breckenridge, Minn., 5.42 in.; Key West, Fla., 5.11 in.; Deadwood, Dak., 5.03 in.; Wilmington, N. C., 5.06 in.

Smallest Monthly Rainfalls.—In southeastern California, Arizona and western New Mexico, as shown upon chart No. III, no rainfall is reported. San Diego, Cal., trace; Kit Carson, Col., 0.02 inches; Pioche, Nev., 0.03 in.; Brownsville, Tex., West Charlotte, Vt., and Mt. Sterling, Ill., 0.05 in.; Fort Union, N. M., 0.06 in.; Fort Griffin, N. M., 0.08 in.; Salt Lake City, Utah, 0.10 in.; Plattsburg Barracks, N. Y., 0.18 in.; Georgetown, Col., 0.20 in. Los Angeles, Col., 0.24 in.; Cape May N. J., and Vernon Centre, N. Y., 0.25

in.; Ft. Preble, Me., 0.26 in.; Burlington, Vt., 0.38 in.; Johnstown, Va., 0.50 in.; Montreal, Can., 0.76 in.; Augusta, Ga., 0.84 in.; Albany, N. Y., 0.89 in.

Rainy Days.—The number of days on which rain or snow has fallen is about as follows: New England, 5 to 14; Middle Atlantic States, 4 to 15; South Atlantic States, 9 to 17; East Gulf States, 4 to 11; Western Texas, 1 to 5; Tennessee and Ohio valley, 7 to 12; Lower Lakes, 8 to 14; Upper Lakes, 7 to 20; Upper Mississippi valley, 10 to 18; Missouri valley, 13 to 16; Red River of the North valley, 9 to 14; Eastern Rocky Mountain Slope, 3 to 8; Deadwood (Black Hills), 13; Rocky Mountains, 2 to 20; Pikes Peak, 6; Western Plateau, 1 to 10; California, 2 to 13; Oregon, 22 and 23; Arizona, 0.

Cloudy Days.—The number of days on which cloudiness averaged eight tenths is as follows: New England, from 1 to 13; Middle Atlantic States, 4 to 10; South Atlantic States, 3 to 19; Gulf States, 2 to 9; Ohio valley and Tennessee, 3 to 6; Lower Lakes, 3 to 7; Upper Lakes, 6 to 18; Upper Mississippi valley, 7 to 16; Missouri valley, 8 to 13; Red River of the North, 12 to 18; Eastern Rocky Mountain Slope, 0 to 4; Rocky Mountains, 1 to 11; Western Plateau, 2 to 8; California, 0 to 16; Oregon, 22 to 25; Arizona, 0 to 4.

Hail.—Red Bluff, Cal., 6th, 21st; Umatilla, Or., 6th; Castroville, Tex., 5th; Graham, Tex., 30th, stones weighing 1 oz.; Henrietta, Tex., 31st; Eagle Pass, Tex., 5th, 3 inches in circumference; Corsicana, Tex., 6th, 25th, 30 miles south of city,, doing great damage to wheat, cotton, and corn crops, track 1½ miles wide, 8 miles long; St. Marks, Flo., 7th; Mobile, Alabama, 5th; Breckenridge, Minn., 10th; Des Moines, Ia., 29th, severe, stones size of walnuts; Burlington, Ia., 31st; Keokuk, Ia., 13th; St, Paul, Minn. 12th; La Cross, Wis., 11th; Milwaukee, Wis., 11th; Toledo, Ohio, 30th; Detroit, Mich., 30th, 31st; Morgantown, W. Va., 14th; Cincinnati, O., 13th, 26th; Indianapolis, Ind., 30th, 6 p. m.; Chattanooga, Tenn., 16th; Smithville, N. C., 17th; Thatchers Island, Mass., 21st; Fort Wallace, Kas., 16th; Fort Sidney, Neb., 21st, 24th; Fort Union, N. M., 5th; Fort Duncan, Tex., 5th, stones very large; Calistoga, Cal., 18th; Olivet, Dak., 24th; Gulf Hammock, Fla., 7th; near Forsyth, Ga., 30th; Mt. Sterling, Ill., 3rd; Anna, Ill., 26th; Fort Wayne, Ind., 30th; St. Meinrad, Ind., 25th, 26th, destructive; Cresco, Io., 3rd, 10th, 11th; Fort Madison, Ia., 29th; Boonsboro, Ia., 29th. Holton, Kan., 19th; near Independence, 26th; Topeka, Kans., 19th, 25th, 29th; Manhattan, Kan., 29th, 30th, Gardner, Me., 1st; Orono, Me., 1st; Sandy Springs, Md., 16th; Emery Grove. Md., 15th; Grand Rapids, Mich., 30th; Thornville, Mich., 31st; Oregon, Mo., 12th, 30th; Plattsmouth, Neb., 19th; Ashley, Mo., 13th; Howard, Neb., 12th; Palermo, N. Y., 31st; Highlands, N. C., 27th, heavy; near Ringgold, Ohio, 19th; Bethel, O., 15th; Cincinnati, O., 13th, 26th; McMinnville, Tenn., 21st; Austin, Tenn., 7th; Snowville, Va., 29th, severe; West Charlotte, Vt., 3rd; Greenwood, Wis., heavy "stones 2½ in. by 3½ in. were formed;" Neillsville, Wis., 11th; Embarrass, Wis., 10th, 11th; Fort Concho, Tex., 30th; North Platte, Neb., 11th.

Snow fell as follows: Total monthly snowfall at Summit Station, Central Pacific R. R., 25½ inches; Emigrant Gap 8 inches, and Truckee, 4 inches. Winnemucca, Nev., 18th, snow fell on surrounding hills; 29th, low down on foot hills. Denver, Col., 30th, on mountains. Santa Fé, N. M., 31st, on mountains. Colorado Springs, Col., 14th, on the Peak. Ft. Garland, Col., 31st. Georgetown, Col., snow-fall during month 40 inches. Deep Creek, Utah, 30th, on mountains. Pioche, Nev., 11th. Santa Fé, N. M., 11th, 31st. Pike's Peak, 11th, 12th (heavy,) 29th. Ft. Sill, Ind. Ty., 30th. Marquette, Mich., 6th. Mt. Washington, N. H., 3rd, 4th, 5th. Eastport, Me., 24th.

Depth of Snow on Ground at end of Month.—Pike's Peak, Col., 38 inches; Red Bluff, Cal., snow still remains on summit of mountains; Georgetown, Col., 2 inches; Rowe, Mass., snow remains around edges of pond; Stratford, Vt., snow disappeared on the 20th.

Droughts.—Campo, Cal., dryest and coldest May for 20 years; springs drying up. Belvidere, Ill., unprecedented drought from April 10th to May 24th. Gulf Hammock, Fla., 31st, crops suffering, especially corn and sugar-cane. Thomasville, Ga., a dry month. Vevay, Ind., 16th, vegetation suffering severely; ground cracking open in many places. Anna, Ill., severe drought has injured strawberries, oats, wheat, etc. Cresswell, Kan., 31st, spring grain suffering, timothy grass dying. Gardiner, Me., May was a warm and dry month. Litchfield, Mich., wheat somewhat injured by dry weather. Somerset, Mass., 8th to 18th, vegetation suffering. Near Brookhaven, Miss., 17th, crops injured by drought in middle of month. Virginia City, Mont., the farmers of the Madison and Ruby valleys, 10 miles from Virginia City, report crops suffering from drought. Vineland, N. J., 21st to 31st. Vernon Centre, N. Y., 31st, grain of all kinds suffering very much. Carawissa, Penn., present month has been exceedingly dry, all vegetation has greatly suffered. North Lewisburg, Ohio, very dry month. Tarentum, Penn., dry month. Stratford, Vt., dryest May for many years. Woodstock, Vt., 31st, very severe in latter part of month. Ft. Gibson, Ind. Ty., 25th to 29th, vegetation drying up, stock suffering. San Antonia, Tex., 28th. Corsicana, Tex., corn and cotton suffering. Indianola, Tex., crops and cattle suffering. Graham, Tex., vegetation suffering. Buffalo, N. Y., 13th. Chattanooga, Tenn., 26th, vegetation becoming parched. Nashville, Tenn., 11th, 12th, 13th. Keokuk, Iowa, advices from adjacent localities in Illinois state that wheat has suffered greatly from drought. West Charlotte, Vt., 31st, severe. Prof. Nipher, in the bulletin of the Missouri Weather Service for May, reported the eastern part of that State suffering greatly from lack of rain and small grain and fruit much injured. Prof. Kingston, in the Weather Review of the Canadian Meteorological Service, says "the months of April and May were, in the vicinity of Lake Ontario, the dryest on record.

Floods.—No important river floods have been reported.

RELATIVE HUMIDITY.

The average percentages of Relative Humidity for the month ranged as follows: New England, 53 to 84; Middle Atlantic States, 57 to 77; South Atlantic States, 55 to 82; Gulf States, 59 to 75; Ohio valley and Tennessee, 50 to 61; Lower Lakes, 54 to 64; Upper Lakes, 59 to 75; Upper Mississippi valley, 54 to 63; Lower Missouri valley, 58 to 68; Red River of the north, 69 to 71; Eastern Rocky Mountain Slope, 43 to 77; Rocky Mountains, 20 to 44; Western Plateau, 26 to 50; California, 45 to 74; Oregon, 74 to 79. *High stations* report the following averages, not corrected for altitude: Mt. Washington, 81; Pike's Peak, 37.

WINDS.

The prevailing winds, at the Signal Corps stations, are shown by the arrows flying with the wind on chart No. II. The *maximum hourly velocities* have been given in the descriptions of the movements of areas of high and low pressure. The highest hourly velocity of the month at Mt. Washington was 133 miles from the NW. on the 27th, and at Pikes Peak 108 miles from the NE. on the 12th.

Total Movements of the Air.—The following are the *largest* monthly movements in miles recorded at the Signal Corps Stations viz: Pikes Peak, 20,025; North Platte, 13,827; Cape Lookout, 12,753; Dodge City, 12,734; Breckenridge, 11,472; Fort Sill, 10,975; Kittyhawk, 10,631. The *smallest* movements are: Boise City, Idaho, 3,555; Visalia, Cal., 3,489; Indianapolis, 3,403; Deadwood, Dak., 3,397; Uvalde, Tex., 3,168; Silver City, N. M., 2,940; Roseburg, Or., 2,408; Nashville, 2,207; Florence, Arizona, 1,656.

Local Storms.—*May* 29th, warm, moist southerly winds, with fair weather, prevailed over Iowa and southward to the Gulf States. About 5 p. m. a hail storm of great violence passed from the SW. to the NE., through Holt Co., Mo., and then, developing into a tornado, passed eastward through the southern part of Nodaway Co., Mo., for about 16 miles having a width of 300 to 3000 feet. It began near Smith passed south of Barnard and north of Bockolow [Bolockow?] and was last seen moving towards Conception, but apparently rose and was dissipated before reaching that place. The north side of the track was straight, clean and well-defined; the south side was jagged, looped and curved. On the same afternoon heavy hail and rain-storms occurred in Lawrence Co. and Riley Co., and many other portions of Kansas. *May* 30th, lower temperatures prevailed in Missouri and Kansas and the advancing edge of the area of cold NW. winds passing eastward over western Nebraska and Kansas, was accompanied by severe local thunder and hail storms, and in some places by tornadoes. At 4:35 p. m., Washington time, (or 3:15 p. m., local time on the 97th meridian) an oval area extended for 300 miles from west of Fort Sill to south of Omaha and having a shorter diameter of about 50 miles; towards this the winds were blowing from all directions, being warm, brisk SW. on the east side and cold, high NW. on the west side. At 11 p. m. this area is represented by a smaller one of low pressure in southeastern Nebraska and two of converging winds respectively in SE. Iowa and central Missouri. Severe tornadoes or equivalent local storms occurred between 3 p. m. and 11 p. m. as follows: 1, Scardia, Republic Co., Kansas. 2, at 4 p. m., tornado passed 4 miles northwest of Minneapolis, Ottawa Co., Kan., path 10 to 15 miles long, 1,000 feet wide; very violent at Delphos, Ottawa Co.; in all 18 persons reported killed. 3, between 6 and 6:30 p. m. tornado passed from Candreys house near county line between Riley and Clay Counties, Kansas, northeastward over or near Stockdale and Randolph, in Riley County; path [30?] miles long; very destructive; 3 persons killed. 4, From 7:45 to 8 p. m. tornado passed eastward over Blue Rapids, Irving and Frankfort, Marshall Co., Kansas, and Centralia, Nemeha Co., Kan.; very severe at Irving; high winds prevailed to long distances from the central path, which was about 30 miles long; in all over 30 persons killed and over 50 severely injured. 5, Richardson Co., Neb., the preceding tornado reported to have reappeared in this county. 6, At 1 p. m. [10? p. m.] near Kirksville, Adair Co., Mo.; 1 person killed. 7, Between 7 and 9 p. m., at Craig, Holt Co., Mo.; this storm was seen by observer at Corning, Holt Co. 8, About 6 p. m. tornado seen to form about 2 miles north of Lee's Summit, Jackson Co., Mo; passed near Blue Springs and Oak Grove, and was seen to dissipate near Judge Williams' house; path northeastward, 10 miles long and 100 feet wide; 5 or 6 killed. This same storm was seen by observers at Independence and Buckner, Mo. 9, In Wayne Co., and at 9:10 a. m., local time, in Appanoose Co., Iowa, at a point 15 miles NE. of Unionville, Putnam Co., Mo.; one killed; (probably a heavy thunder and hail storm rather than a well developed tornado).

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for May with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of omissions to be 0.2 per cent, and of verifications to be 82.9 per cent. The percentages for the four elements have been, Weather, 85.8; Direction of the Wind 85.2; Temperature, 82.6; Barometer, 77.9. The percentages of verifications by geographical districts have been: New England, 84.3; Middle States, 85.6; South Atlantic States, 80.4; East Gulf States, 76.6; West Gulf States, 76.7; Lower Lake region, 84.7; Upper Lake region, 87.1; Tennessee and the Ohio valley, 84.2; Upper Mississippi valley, 84.1; Lower Missouri valley, 84.0; North Pacific coast region, 93.1; Central Pacific coast region, 85.4; Southern Pacific coast region, 93.1. Of the 3,790 predictions that have been made, 160, or 4.2 per cent, are considered to have entirely failed; 145, or 3.8 per cent, were one-fourth verified; 580, or 15.3 per cent, were one-half verified; 353, or 9.3 per cent, were three-fourths verified; 2,552, or 67.3 percent, were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary Signals.—178 Cautionary Signals were displayed during the month, of which 110, or 61.8 per per cent, were justified. 42 Cautionary Off-shore Signals were displayed, and of these 30, or 71.4 per cent, were justified as to direction; 17, or 40.5 per cent, were justified as to velocity. Of the Cautionary Off-shore Signals 20 were changed from Cautionary. 220 signals of both kinds were displayed, of which 126, or 57.3 per cent, were fully justified. The above does not include signals ordered at 47 display stations, where the velocity is only estimated and not measured. 54 cases were reported of winds of 25 miles or over where signals were not ordered; in only 12 of these cases did the winds exceed 30 miles per hour.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Corps river gauges for the month, with the dates. No case has been reported of the rivers reaching danger line during the month. The Upper Mississippi was lowest during the early part of the month, and the Ohio was lowest during the latter portion of the month. Dubuque, Ia., 30th, the excellent stage of water in the river brought down a great quantity of logs and gave work to all mills. The Black river, Wis., on the 14th, rose 10 feet, producing the highest water for 10 or 12 years. Pittsburgh, 31st, "on account of low water during past few weeks it has been impossible to float loaded barges down the river."

Ice on Lakes, Rivers, &c.—Marquette, Wis., 8th, navigation opened; heavy ice reported beyond the Sault Sainte Marie Canal, but not preventing navigation. Buffalo, N. Y., 1st, several vessels forced their way through ice, outward bound; 2nd, harbor closed by ice; 5th, ice in harbor 3 feet thick; 7th, ice softening and vessels passing out; 9th, large masses of floating ice passing down Niagara river; 15th, ice firm navigation suspended; 16th, ice broke up; 20th, no ice observed on lake.

High Tides.—Cape Lookout, N. C., very high tide on the 3rd.

TEMPERATURE OF WATER.

The *temperature of water*, as observed in rivers and harbors, with average depth when observations were taken, are given in table on chart No. II. Observations were interrupted at the following places on the dates indicated: on account of rough water, Cleveland, 25th and 26th; on account of loss of thermometers, San Francisco, 1st to 31st, Milwaukee, 13th to 29th, New London, 16th to 31st, Augusta, Ga., 1st to 4th.

ATMOSPHERIC ELECTRICITY.

Thunder Storms.—1st, Me., Dak., Ga., Tex.; 2nd, La.; 3rd, Dak., Tex., Ia., Mo., Ill., Kan., Neb.; 4th, Ind. Ty., Tex., Miss., Mo., Ohio, Ill., Tenn., Ala., Ark., Neb., Ohio, Va.; 5th, Ind. Ty., Tex., Ala., Md., Ark., Ga., Mass., N. J., N.Y., Vt.; 6th, Col., Tex., La., Ala., Ga., Conn., N. Y., Ark., Miss., N. J.; 7th, Neb., Fla. N. C., Ala., Mich.; 8th, Dak., Fla.; 9th, Ia., Minn., Dak., Mo.; 10th, Dak., Ia., Minn., Wis., Ill., Mich., Pa.; 11th, Col., Wyo., Neb., Tex., Fla., Ia., Wis., Mich., Minn., Dak., Ill., Mo.; 12th, Neb., Dak., Tex., Minn., Mich., Ill., Mo.; 13th., Cal., Kan., Dak., Ia., Mo., Wis., Ohio, Mich., Penn., Ky., Ill., Tenn., N. C., Mo., Ala., Ind., Me., Neb., Tex., Vt.; 14th, Col., Ill, Ohio., N. Y., Tenn., Me., Ala., Ind., Ia., Kan., Mich., Mo., Vt.; 15th, Tex., Fla., N. Y., Penn., Ohio, Ky., Ill., Tenn., Ga., N. C., Ind., Va.; 16th, Neb., Kan., Tex., Fla., N. C., Ga., N. Y., Mass., Md., Conn., N. J., Penn., Vt., Va.; 17th, Col., Fla., La., N. C., Ga., Dak., Neb., Kan., Md., N. J., Pa., S. C., Va.; 18th, La., Fla., N. C., Ga., Va., Penn., Mass., Ia., Kan., Md., Mo., Neb., N. J., S. C.; 19th, Neb., Kan., Dak., Ia., Ga., Va., Me., Ala., Ill., Md., Mo., N. J., N. C., Ohio, Pa.; 20th, Ind. Ty., Fla., Mo., Mich., Ky., Tenn., N. C., Ga., Va., Vt., Kan., N. J., Pa.; 21st, Cal., Neb., Dak., Miss., Fla., N. C., N. J., Va., Penn., Mass., Conn., Me., Md., N. Y., S. C., Tenn., Vt.; 22nd, Kan., Dak., Tex., Ga., N. Y., Ia.; 23rd, Dak., Miss., Ala., Fla., Minn., Ga., Kan., Mo., Neb.; 24th, Cal., Tex., Ia., Wis., Mich., Neb., Wyo. Ty., Dak., Ill., Ind., Mo., Ohio; 25th, Dak., Ia., Wis., Ill., Ohio, Penn., Ind., N. Y., Conn., Kan., Md., Mich., N. J., Va., W. Va.; 26th, Ohio, Ky., Ill., Ind., N. C., Ia., Kan., Mich., Mo., N. M.; 27th, Ia., Ill., N. C., Kan., Neb., Pa., S. C.; 28th, Tex., Minn., Wis., Dak., Ill., Ind., Ia., Mich., Neb., N. C., Va.; 29th, Kan., Dak., Minn., Ia., Minn., Mich., Ky., Ind., Ill., Mo., Neb., N. C., Ohio, W. Va.; 30th, Ind. Ty., Tex., Miss., Ia., Mo., Wis., Mich., Ohio, Ill., Kan., Neb., N. Y.; 31st, Tex., Ia., Mo., Wis., Mich., N. Y., Penn., Ill., Tenn., Mass., Ark., Ind., Kan., Miss., Neb., Ohio, W. Va.

Auroras were observed on the following dates: 7th, Starkey, N. Y.; 11th, Vevay, Ind.; 12th, Thornville, Mich.; 13th, Pembina, Dak.; 17th, Pembina, Dak.; 20th, Pembina, Dak., Starkey, N. Y.; 21st, Philadelphia; 23rd, Bismarck, Dak., NE., 10 p. m., Eastport, Me., Monticello, Iowa, Gardiner, Me., Woodstock, Vt.; 24th, Newburyport, Mass.; 25th, Bangor, Me., from 10 p. m. until 2:45 a. m., Starkey, N. Y.; 26th, Cambridge, Mass., regularly looked for at 8 p. m., none seen; cloudy on 2nd, 3rd, 4th, 6th, 7th, 12th, 13th, 16th, 17th, 18th, 19th, 24th, 25th, 27th, 30th; moonlight, 1st, 5th; twilight strong last half of month.

Telegraphic Communication Interfered with by Atmospheric Electricity.—Santa Fe, N. M., 4th, 26th; Colorado Springs, Col., 26th; Pikes Peak, Col., 27th; St. Paul, Minn., 12th.

OPTICAL PHENOMENA.

Solar Halos.—1st, Utah, Ill. 2nd, Dakota, Fla. 3rd, Utah, Ohio, Mich, N. J. 4th, Ohio, Ind. 5th, Utah, Me., Ill., N. C., Va., Conn., Ia., Mass., Neb., N. J. 6th, Utah, Ia., Ohio, Ill., Conn., Mo., N. H., N. J.

7th, Ia., Minn , Conn., Ind. 8th, Dak., Ia., Wis., Ill. 9th, Ia., Ill., Ohio., N. Y. 10th, Ohio, N. Y., Me., Ind., Neb. 11th, Ia., Mo., Ind., Ohio. 12th, Cal., Dak., Ia., Mo. 13th, Ia. 15th, Ohio, Conn., Ill., Neb., N. Y. 17th, Ia. Ohio, Mass., Neb., N. C. 18th, Ia., N. C., Mass., N. J. 19th, Ia. N. Y. 20th, Ia., Tenn. 21st, Nev., Dak., Ia., Minn., Ohio, Ind. 22nd, Fla., Ia., Ohio. 23rd, Tex., Fla., Ia. 24th, Nev., Ia. 25th, Mich., Ohio, Ind. 26th, Cal., Utah, N. C., Nev., N. J., Penn. 27th, Utah, Nev., Ia., Tenn., Cal., Ind., Me. 28th, Ohio, Dak. 29th, Dak., Ia., N. Y., N. J. 30th, Tex., Ia., Wis., Ill., Mich., N. Y. 31st, Fla., Ala., Ia., Ga.

Lunar Halos.—1st, N. Y., Ill., Va., Mass. 2nd, Iowa, Minn., Mo. 3rd, Utah, Kan., Tex., N. C., Va. 4th, Dak., Tex., Ohio, Ill., N. C., Me., Cal., Ind., Md. 5th, Tex., Ala., Fla., Iowa, Ohio, Ky., Ill., Tenn., Ind., Penn., Va. 6th, Mo., Ohio, Va. 8th, Mich. 9th, Mich. 11th, Tex. 14th, Ohio, Ind. 23rd, Mo. 24th, Nev., Tex., Tenn., Ind., Ill. 26th, Nev., Iowa, Ill., Mass., Mo., Tex. 27th, Dak., Fla., Iowa, Mo., Ky., Ill., Ind., Ohio. 28th, Ind. Ty., Dak., Minn., Tenn., Ga., N. C., N. J., R. I., Mass., Ill., Mich., Neb., N. Y. 29th, Tex., Tenn., Ga., Ill., Mich., N. J., Va. 30th, Tex., Ala., La., Mo., Ind., Ga., Me., Mass., N. J. 31st, Tex., Ala., Fla., Mo., Ga., Conn., Mass., Penn.

MISCELLANEOUS PHENOMENA.

BOTANICAL.—*Connecticut*—Southington, in bloom, 8th, sugar maple, 14th cherry. 18th, pear, apple; New London, in bloom, 10th, wistaria, 12th, lilac, 14th, horsechestnut, maple, elm. *Georgia*—Thomasville, a dry month; oats and wheat all harvested, average crop. Cotton caterpiller observed in three cases in Thomas County during the month. *Illinois*—Louisville, corn, oats and flax one month later: Peoria, in bloom, 6th, wild cherry; Highland, 14th, first ripe strawberries; 18th, grape vines in bloom; 29th, cut worms damaging corn; 31st, wheat looks poorly. *Indiana*—St. Meinrad, 20th, grapes in bloom, Arlington, in bloom, 2nd, hickory, 19th, walnut, 24th, red and white clover. *Indian Territory*—Fort Gibson, 18th, new irish potatoes in market. *Iowa*—Nora Springs, in bloom, 2nd, cherry, 17th, mandrake. Monticello, 1st, catkins on willow; 12th, farmers commenced cultivating corn: in bloom, 4th, cherry, 11th, lilac, 13th, snowball, showberry. Independence, ripe, 7th, strawberry, 24th, potatoes, 26th, raspberry. Fort Madison, in bloom, 18th, strawberry, black walnut, 7th, locust; 19th, ripe strawberries in market. Prof. Gustavus Hinrichs, of the Iowa Weather Service, reported crops at end of month much better than apprehended during the drought of first part of month; corn, equal or above average over two-thirds of state, below average in southwest and northeast; hay and pasture good in northwest and middle portions, below in southwest and east; wheat and oats below average, having suffered most in northwest, southwest and east. *Kansas*—Independence, blooming, 2nd, peas, 15th, hickory, walnut, 30th, catalpa, 31st, flax. Topeka, 5th, yellow rose in bloom. *Maine*—Cornish, leafing, 3rd, lilac, 10th, birch, maple, poplar, horse chestnut, 11th, forest trees. West Waterville, in bloom, 15th, plum, cherry, 21st, apples. Gardiner, in bloom, 28th, lilac; season more forward than last year. *Maryland*—Emory Grove, in bloom, 20th, rose, 30th, potato; in head, 12th, wheat, 15th, rye; 28th, strawberries ripe; 30th, corn up. *Massachusetts*—Somerset, in bloom, 1st, wild flowers and feverbush, 10th, cherry, 13th, pear, 14th, peach, plum, 17th, apple, 19th, lilac, 24th, quince, 1st, blue violet, cowslip, adder's tongue, anemone, 10th, columbine, 15th, buttercup, 20th, solomon's seal; 6th, asparagas for table use; 30th, rye in head. Fall River, in bloom, 6th, cherry, 8th, peach, 9th, pear, 12th, strawberry, 14th, apple. Westborough, in bloom, 11th, cherry, 12th, peach, 14th, apple. Springfield, in bloom, 12th, peach, plum, 13th, pear. Rowe, 28th, apple in bloom. Waltham, in bloom, 2nd, red maple, 6th, willow, 8th, marigold, dandelion, 10th, anemone, 12th, cherry, 13th, shad bush, white birch, 14th, peach, pear, 16th, gooseberry, blueberry, 17th, sassafras, 18th, apple, 20th, black oak, chokeberry, 21st, lilac, horse chestnut, 25th, buttercup, wild geranium, 29th, barberry, white thorn, 30th, blackberry, 31st, sweet viburnum, black cherry; leafing, 5th, black cherry, choke cherry, barberry, willow, meadow sweet, and sweet viburnum, 8th, horse chestnut, sugar maple, 10th, pear, white thorn, 11th, apple, 12th, white birch, 13th, red oak, red maple, 14th, raspberry, gooseberry, 24th, forest trees. New Bedford, leafing, 2nd, lilac, willow, 19th, elm, oak; in bloom, 2nd, anemone, 5th, magnolia, 6th, wild strawberry, 8th, peach, 12th, pear, butter cup, 15th, apple, 18th, lily of the valley, 19th, dogwood, 25th, solomon's seal; ripe, 2nd, asparagus. *Michigan*—Litchfield, all small fruit prosperous. Northport, in bloom, 16th, early cherry, 17th, shadbush, plum, wild cherry. Thornville, in bloom, 8th, juneberry, 9th, cherry, peach, 11th, plum, 12th, poplar; leafing, 2nd, elm, willow, apple, 6th, wild cherry, whitethorn, 12th, white oak. Hudson, 1st, cherry in bloom. *Mississippi*—Brookhaven, in bloom, 1st, magnolia, 7th, lily; 3rd, lily budding; 17th, blackberry ripe. Fayette, in bloom, 7th, black walnut, morning glory; 20th, may apple ripe. *Missouri*—Oregon, in bloom, 1st, indian turnip, morning glory, shellbark, hickory, black walnut, 2nd, blue larkspur, 3rd, persian lilac, 5th, sweet shrub, 6th, snowballs, horse radish, 8th, white walnut, 9th, pear, 10th, blue grass, wild cress, sage, 11th, star of bethleham, yellow locust, 12th, flowering locust, 13th, red and yellow raspberries, 14th, doolittle raspberry, 15th, wild blackberry, 16th, orchard grass, 17th, brandywine raspberry, 18th, rose peony, red clover, 19th, clinton grapes, 20th, solomon's seal, beauty of hebron, early rose potato, 21st, thyme, 22nd, philadelphus, 24th, syringa, curled cress, parsnip, 26th, radish, canada victor tomato, 27th, rose, scarlet phlox, wild buckwheat, 28th, calistigea, white larkspur, 24th, dogwood, dwarf prairie rose, 30th, may weed; 2nd, blue grass heading; 4th, wild strawberry begins to ripen; 14th, farmers cultivating corn; 17th, strawberry begins to ripen. 31st, blue grass seed begins to ripen. *Nebraska*—Clear Creek, 13th, farmers planting corn. *New Hampshire*—Dunbarton, 26th, apple in bloom; season very backward. Contoocookville, in bloom,

3rd, red maple, 17th, wild strawberry, 24th, apple; leafing, 12th, elm, apple, 27th, concord grape. *New Jersey*—Princeton, in bloom, 4th, cherry, 11th, apple. Atco, in bloom, 6th, apple, 14th, quince; 6th, oak leafing; 22nd, rye heading; 23rd, strawberry ripe. Flushing, in bloom, 5th, peach, cherry, 6th, plum, apple, pear, 16th, lilac; 12th, trees generally in full leaf. *New York*—Argyle, in bloom, 16th, dandelion. Vernon Centre, in bloom, 5th, willow; budding, 5th, apple, pear, 14th, cherry. Palermo, in bloom, 3rd, soft maple, 14th, cherry, flowering currant, 15th, pear, strawberry, 16th, apple, 17th, tulip, flowering almond, 21st, black alder, 22nd, butternut, lilac; 2nd, began to sow oats; 7th, forest trees leafing; 22nd, began planting corn. Starkey, in bloom, 5th, dandelion, 10th, strawberry, 12th, cherry, 13th, lilac, 16th, pear, peach, 31st, clover; leafing, 2nd, currant, 3rd, cherry, 8th, apple, 15th, oak, elm, hickory; 25th, rye heading. Nile, leafing, 10th, forest trees, apple. Waterbury, in bloom, 9th, dandelion, 13th, plum, cherry, peach, 14th, pear, 17th, apple. *North Carolina*—Weldon, 31st, month remarkably favorable for crops; cotton never looked better. Fayetteville, in bloom, 17th, magnolia; 22nd, raspberries ripe; 31st, early wheat ready to cut; 5th, strawberry and green pea ripe. *Ohio*—Ruggles, in bloom, 9th, cherry, peach, 12th, apple. Margaretta, in bloom, 5th, cherry, 7th, peach, 9th, pear, apple, wild plum, 12th, lilac. Jacksonburg, 6th, quince in bloom. Cleveland, in bloom, 16th, horse-chestnut, lily. Ringgold, 11th, corn doing very poorly; oats, potatoes, tobacco very backward; grass, fruit and wheat crops short. North Lewisburg, fair yield of fruit in prospect. Bellefontaine, 11th, apples in bloom, nineteen days later than last year; 14th, corn planting. *Pennsylvania*—Hulmesville, crops very promising. Litchfield, in bloom, 14th, cherry, peach, plum, 23rd, apple. *Tennessee*—Chattanooga, in bloom, 5th, strawberry, 8th, Wisteria. *Texas*—Mesquite, early wheat cut on the 6th, but nearly all eaten by birds; wheat birds left on the 15th; they were more numerous, staid longer, and did more damage than ever before; 29th, chinch bug in wheat. Corsicana, 31st, cotton blooming. Indianola, crops backward. *Vermont*—West Charlotte, leafing, 3rd, gooseberry, flowering ash, 14th, forest trees; in bloom, 13th, tulip, 14th, cherry, 17th, plum, pear, peach. Woodstock, in bloom, 18th, plum. Lunenburg, in bloom, 15th, plum, 23rd, apple. Strafford, in bloom, 15th, cherry, plum, 21st, apple. *Virginia*—Johnsontown in bloom, 4th, dogwood, 12th, rice. Dover Mines, 12th, wheat heading. Walnut Grove, ripening, 22nd, wild strawberry; 24th, locust in bloom. Wytheville, 31st, oats, grass, wheat, below the average. *Wisconsin*—Embarras, in bloom, 7th, dandelion, wild plum, 10th, fleur de lis, 13th, apple, 15th, strawberry. Madison, in bloom, 3rd, cherry, 5th, strawberry.

BIRDS.—*Bluebirds*—Pilot Point, Tex., 16th. *Bluejays*—Creswell, Kan., 1st. *Bobolinks*—Southington, Conn., 15th; Elmira, Ill., 4th; Monticello, Ia., 21st; West Waterville, Me., 12th; Rowe, Mass., 10th; Waltham, Mass., 10th; Contoocookville, N. H., 8th; Nile, N. Y., 11th; Vernon Centre, N. Y., 9th; Palermo, N. Y., 9th; North Valley, N. Y., 12th; Waterburg, N. Y., 5th; Norwalk, Ohio, 7th; West Charlotte, Vt., 12th; Woodstock, Vt., 10th; New London, Conn., 10th; New Bedford, Mass., 8th. *Bobwhites*—New London, Conn., 16th. *Brants*—Plattsmouth, Neb., 7th. *Catbirds*—Southington, Conn., 7th; Elmira, Ill., 7th; Emory Grove, Md., 9th; Waltham, Mass., 2nd; Palermo, N. Y., 26th; New London, Conn., 8th; New Bedford, Mass., 2nd. *Cuckoos*—Elmira, Ill., 29th; Northport, Mich., 29th; Vernon Centre, N. Y., 14th; Embarras, Wis., 22nd. *Ducks*—Monticello, Ia., 5th. *Wild Geese*—Plattsmouth, Neb., 7th, a month later than usual; Winnemucca, Nev., 12th; Bismarck, D. T., 26th; New London, Conn., 4th. *Hummingbirds*—Monticella, Ia., 28th; Emory Grove, Md., 7th; Fallston, Md., 7th; Litchfield, Mass., 10th; Vernon Centre, N. Y., 10th; Palermo, N. Y., 16th; Norwalk, Ohio, 24th; West Charlotte, Vt., 13th; Woodstock, Vt., 13th; Dover Mines, Va., 14th; Embarrass, Wis., 19th; New London, Conn., 2nd. *Kingbirds*—Southington, Conn., 6th; Monticello, Ia., 11th; Rowe, Mass., 4th; Northport, Mich,, 13th; Plattsmouth, Neb., 6th; Palermo, N. Y., 9th; Waterburg, N. Y., 12th; West Charlotte, Vt., 15th; Embarrass, Wis., 13th; New London, Conn., 8th. *Ladybirds*—Oregon, Mo., 5th. *Martins*—Creswell, Kan., 8th; Emory Grove, Md., 9th. *Mockingbirds*—Embarrass, Wis., 1st; Creswell, Kan., 6th. *Nighthawks*—Southington, Conn., 15th; Monticella, Ia., 18th; Creswell, Kan., 22nd; Emory Grove, Md.. 27th; Waterburg, N. Y., 28th; Fayettsville, N. C., 15th; Woodstock, Vt., 15th; Dover Mines, Va., 7th. *Orioles*—Rowe, Mass., 12th; Waltham, Mass., 6th; Litchfield, Mass., 11th; West Charlotte, Vt., 12th; Southington, Conn., 8th; Vernon Centre, N. Y., 9th; Palermo, N. Y., 10th; New London, Conn., 10th; New Bedford, Mass., 8th. *Orchard Orioles*—North Volney, N. Y., 11th. *Phoebes*—Northport, Michigan, 19th. *Pigeons*—Pembina, Dak., 13th. *Quails*—Emory Grove, Md., 3rd. *Redbirds*—North Volney, N. Y., 10th. *Ricebirds*—Corsicana, Tex., 9th. *Robins*—Springfield, Mass., 10th. *Golden Robins*—Monticello, Ia., 5th. *Swallows*—Fort Adams, R. I., 27th; Southington, Conn., 1st; Monticello, Ia., 4th; Emory Grove, Md., 1st; Nile, N. Y., 11th; Coalville, Utah, 13th; Pembina, Dak., 3rd. *Barnswallows*—Northport, Mich., 16th; Argyle, N. Y., 5th; Woodstock, Vt., 4th. *Cherryswallows*—Monticello, Ia., 10th. *Chimneyswallows*—Northport, Mich., 9th; Woodstock, Vt., 9th. *Thrushes*—Waltham, Mass., 15th. *Wheatbirds*—Mesquite, Tex., 2nd. *Whippoorwill*—Monticello, Ia., 26th; Cresco, Ia., 1st; Waltham, Mass., 5th; Northport, Mich., 17th; Nirvana, Mich., 4th; Clear Creek, Neb., 16th; Contoocookville, N. H., 4th; Palermo, N. Y., 12th; North Volney, N. Y., 12th; Litchfield, Pa., 12th; Yankton, Dak., 9th. *Woodpeckers*—Emory Grove, Md., 1st. *Red-headed Woodpeckers*—Northport, Mich., 11th. *Wrens*—Oregon, Mo., 1st; Palermo, N. Y., 9th; Norwalk, Ohio, 2nd. *Yellowbirds*—Northport, Mich., 20th; Oregon, Mo., 11th; Palermo, N. Y., 12th.

FISH.—New London, Conn., 2nd, *shad* in market; Flushing, N. Y., 14th, first *bass* caught.

MISCELLANEOUS.—*Grasshoppers*—Salt Lake City, Utah, 23rd, numerous; Pilot Point, Tex., native grasshoppers very thick on prairie; Breckenridge, Minn., 28th; Wellington, Kan., 17th; Emory Grove, Md., 1st, 4th, 22nd to 31st; Contoocookville, N. H., 24th; Bellefontaine, Ohio, 11th. *Seventeen-year lo-*

casts—Leavenworth, Kan., Independence, Kan., 24th; Oregon, Mo., 12th; Plattsmouth, Neb., 27th, in large numbers. *Butterfly*—New London, Conn., 6th. *Nettleworm butterfly*—New London, Conn., 8th. *Colorado beetle*—New London, Conn., 14th. *Fireflies*—St. Meinrad's, Ind., 12th; Monticello, Ia., 29th; Independence, Kan., 4th; Fallston, Md., 25th; Oregon, Mo, 22nd; Clear Creek, Neb., 25th; Linden, N. J., 30th; Waterbury, N. Y., 31st; Argyle, N. Y., 25th; Bethel, Ohio, 18th; Jacksonburg, Ohio, 20th; Austin, Tenn., 5th; Woodstock, Vt., 29th; Dover Mines, Va., 18th. *Humblebees*—Monticello, Ia., 2nd; Emory Grove, Md., 1st; Northport, Mich., 9th; Vernon Centre, N. Y., 10th; Palermo, N. Y., 10th; Woodstock, Vt., 11th. *Dragon fly*—Monticello, Ia., 3rd. *Snakes*—Monticello, Ia., 5th; Emory Grove, Md., 3rd; Northport, Mich., 15th. *Beetle*—Monticello, Ia., 9th. *Tree toad*—Monticello, Ia., 30th; Oregon, Mo., 20th; Palermo, N. Y., 12th. *Potato bug*—Emory Grove, Md., 7th, 9th, 20th to 31st; Litchfield, Mich., 11th, abundant; Mendon, Mass., 31st; Fall River, Mass, 17th; Springfield, Mass., 17th, numerous; Contoocookville, N. H., 30th; Freehold, N. J., 23rd, more abundant than last year; Vineland, N. J., 31st; Palermo, N. Y., 20th; Waterbury, N. Y., 22nd; Strafford, Vt., 21st. *Ground squirrels*—Emory Grove, Md. 9th. *Honey bee*—Emory Grove, Md., 25th, 29th, 30th, swarming; Jacksonburg, Ohio, 25th, swarming. *House fly*—Emory Grove, Md., 7th; Clear Creek, Neb., 26th; Woodstock, Vt., 31st. *Spotted adder*—Northport, Mich., 15th. *May bugs*—Oregon, Mo., 8th, 9th, 10th; Vernon Centre, N. Y., 10th. *Crickets*—Oregon, Mo., 23rd; Contoocookville, N. H., 24th; West Charlotte, Vt., 25th. *Frogs*—Clear Creek, Neb., 17th; West Charlotte, Vt., 14th; Contoocookville, N. H., 4th. *Mosquitoes*—Flushing, N. Y., 13th. *Wasps*—Norwalk, Ohio, 8th. *Tadpoles*—Oregon, Mo., 1st, hatching. *Bats*—Monticello, Ia., 4th; Emory Grove, Md., 4th.

Meteors.—New Orleans, La., 4th, 7:55 p. m., observed in eastern sky, brilliant green color, fell from an altitude of 30° deflecting to the north, path marked by train of reddish-yellow light. St. Marks, Fla., 4th, 8.30 p. m., large and brilliant meteor in SW., "at an altitude of 5°; it was preceded by a hissing noise and detonated the moment it was seen, presenting the appearance of a roman candle, being visible about 3 seconds." Cairo, Ill., 26th, 8:45, p. m., started from SW. of great bear, altitude of 50° moved from N. to S., resembled a brilliant ball 5 in. in diameter, with train of light 18 in. long. Indianapolis, Ind., 7th, 24th, 25th. Springfield, Ill., 23rd, 24th, 26th, 27th. Holton, Kan., 17th. Topeka, Kan., 16th. Woodstock, Md., 10th, 11th, 13th, 14th, 20th, 21st, 23rd. Emory Grove, Md., 12th. Rowe, Mass., 13th. Near Fayette, Miss., 14th, 21st, 24th, 25th. Hector, N. Y., 7th. Fayetteville, N. C., 24th. Bethel, Ohio, 5th. Jacksonburg, Ohio, 20th, 21st, 23rd. Princeton, N. J., 29th. Prof. G. Hinrichs reports a "brilliant meteor in the northwest at 5 p. m. of the 10th; detonations of extreme violence marked the end of its path over Dickinson and Emmet Cos., which were heard over a hundred miles in every direction. Two large *meteorites*, of the class *syssideres* have thus far been found, weighing 460 and 150 lbs. respectively.

Polar Bands.—New Corydon, Ind., 6th, 16th, 20th, 24th, 25th, 26th, 31st. Guttenburg, Iowa, 17th. Gardiner, Me., 4th, 7th, 30th, 31st. Clear Creek, Neb., 26th. Freehold, N. J., 26th. Bellefontaine, Ohio, 17th. Woodstock, Va., 17th. Wytheville, Va., 1st, 6th, 21st, 22nd.

Prairie and Forest Fires.—Bismarck, D. T., 14th. Burlington, Vt., 26th. Morgantown, W. Va., 5th and 6th, on mountains. Yankton, Dak., 5th, E. and W. of station, 14th. Georgetown, Col., 20th, extensive. Creswell, Kan., 1st to 5th, 18th to 20th. Independence, Kan., 1st to 31st. Emory Grove, Md., 12th to 28th, great damage to property, several lives lost. Oregon, Mo., 7th, 8th. Freehold, N. J., 10th. Atco, N. J., 9th. Starkey, N. Y., 12th. Litchfield, Pa., 8th to 16th, in every direction doing much damage to timber-land. Catawissa, Pa., 9th to 16th. Wellsboro, Pa., 5th to 14th, extensive. Wytheville, Va., 1st, 10th, 11th, 12th. Embarass, Wis., 30th, destroying 300 acres of timber.

Mirage.—Olivet, Dak., 6th, 11th, 18th, 20th, 26th. Breckenridge, Minn., 1st. New London, Conn., 8th, 9th. New Haven, Conn., 15th.

Zodiacal Light.—Southington, Conn., 8th, 10th, 11th. Monticello, Ia., 15th, 16th, 20th. Cambridge, Mass., regular, looked for at 8 p. m.; seen on 8th only; clouds and moonlight hindered observations earlier in month than afterwards. Waterburg, N. Y., 8th. Bellefontaine, Ohio, 22nd. Wytheville, Va., 8th, 9th.

Earthquakes.—Princeton, Cal., 26th, 8.40 p. m., slight shocks. U. S. Naval Hospital, Yokohama, Japan, March 16, 1879, 9.32 p. m., shock; 18th, 9.49 a. m., light shock.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather, for the succeeding twenty-four hours, have been observed at all Signal Corps stations. Reports from 131 stations show 4,034 observations to have been made, of which 53 were reported doubtful; of the remainder, 3,354 or 84.2 per cent. were followed by the expected weather.

Sun Spots.—The following record of observations, made by D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac, Washington, D. C.:

Date—May, 1879.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
6th, 5 p. m.	1	1	0	0	1	1	1	1	Faculæ.
7th, 3 p. m.	0	2	0	0	0	2	1	3	Faculæ.
5 p. m.	0	0	0	0	0	0	1	3	Faculæ.
8th, 3 p. m.	0	1	0	0	0	1	1	4	Faculæ.
9th, 2 p. m.	0	0	0	0	0	0	1	4	Faculæ.
15th, 4 p. m.	0	0	0	0	0	0	1	4	Veiled spots of faculæ.
16th, 5 p. m.	0	0	0	0	0	0	1	4	Veiled spots in large groups of faculæ.
20th, 2 p. m.	0	0	.....	.....	0	0	0	0	

On the 1st, at 4 p. m., 3rd, at 3 and 5 p. m., 5th, at 2 p. m., 21st, at 2 p. m., 22nd, at 2 p. m., 23rd, at 2 p. m., 24th, at 2 and 4 p. m., 25th, at 5 p. m., 27th, at 4 p. m., 28th, at 2 p. m., 29th, at 2 and 4 p. m., 30th, at 2 p. m., and 31st, at 2 p. m., observations were made, but no spots seen. Mr. W. Dawson, of Spiceland, Ind., reports having observed the sun every day, with the following results: No spots on the 1st, 4th, 5th, 6th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 27th, 28th, 30th, 31st. On the 2nd, two groups of one and four spots; 7th, one group, four spots; 8th, one group, twelve spots, and prominent faculæ near east point; 9th, one group, eleven spots, one spot near the faculæ of yesterday; 10th, one group, nine spots; 11th, one group, nine spots; 12th, one group, four spots; and on the 13th, the group had dwindled to one little spot. Mr. David Trowbridge, Waterburg, N. Y., examined the sun on 3rd, 5th, 6th, saw no spots; 8th, saw group of two, one large, one small, near eastern margin of disc, brought on by solar rotation; 10th, one spot, faint; 11th, 12th, one spot, faint; 14th, 15th, 17th to 26th, 28th to 31st, none. Mr. H. D. Gowey, North Lewisburg, Ohio, observed no spots during month. Prof. G. Hinrichs, Iowa City, Iowa, reports sun's disc "examined on twelve days without seeing a spot."

NOTES AND EXTRACTS.

Mr. Joao Capello writes to *Nature* as follows: "In *Nature* of March 6th, p. 420, in regard to an appreciation of the meteorological observations of the Hydrographic Office at Pola, appears the following: 'The amount of this third maximum is very small, and the evidence yet adduced is not sufficient to determine whether it is a real increase of atmospheric pressure or merely an apparent increase due to undetected instrumental errors.' We remarked this secondary maximum of the barometer in an investigation of the diurnal variations of pressure at Lisbon, before knowing that Mr. Rikatscheff had written a memoir on this subject, and we can affirm that the said maximum is not due to instrumental errors; the examination which we made was of a series of 12 years of horary observations, taken from a barograph, (photographic system,) and we proved as follows: 1st, Not one of the 12 curves of atmospheric pressure, corresponding to the 12 months of December or the 12 months of January, has failed to show the said secondary maximum between the 13th and 15th hours. 2nd, The values of the average errors in those hours, (13th, 14th, 15th,) are smaller than the probable errors of other hours of the day. 3rd, In grouping the hourly pressures of clear and calm days of January and of December, during the whole series of 12 years, the maximum in question, stands forth more regularly, and is much more developed than in the curves of the mean pressures of the same months. It seems to me that the existence of this secondary maximum, very difficult to explain, and which renders more obscure the explanation of the double diurnal oscillation of the barometer, is demonstrated.'"

[*From Comptes Rendus.*]

The following extract is taken from a letter of Mr. F. A. Forel: "A cyclonic-hurricane passed over Switzerland during the evening of February 20th, 1879; I find in the study of the phenomena an indirect proof of a gyratory movement of the atmosphere which seems to me very convincing. After a very marked calm which had during the day, (February 20th,) succeeded the southwest wind blowing in our valley since February 16th, suddenly a gale of exceptional violence sprung up. Over a track 12 to 20 kilometres (7.4 to 12.4 miles) wide, the hurricane overturned or carried away tiles and window panes, chimneys and roofs of houses, isolated trees or entire groves, and shipwrecked upon Lake Leman some fishing boats; the zone of devastation passed quite exactly through Geneva, Lausanne, Fribourg and Berne. Upon two sides of this zone a comparative calm prevailed; squalls from the southwest on the north side of the storm, and *foehn* (southeast wind) in the valley of the Rhone from Martigny to Vevey to the south of the path of the cyclone. 'The sudden commencement of gale allowed a quite exact measurement of the velocity of its translation. Here are the approximate figures which I have been able to gather:

Station.	Time of commencement.		Distance from Geneva.		Duration of translation in minutes.	Velocity of translation.	
	hour.	min.	Kilometres.	Miles.		Metres per second.	Miles per hour.
Geneva	5	45	.....	.....	.....	.....	.....
Morges	6	35	43	26.7	50	14	31.3
Lausanne	6	45	51	31.7	60	14	31.3
Fribourg	8	10	102	63.4	145	12	26.8
Berne	8	50	129	80.2	185	12	26.8

"We have on the other hand a very exact report of the average velocity of the wind at a given point within the area of the phenomena. The anemometer of the Berne Observatory, of which Prof. A. Förster has very obligingly sent me notes, indicated as the wind's velocity:

Interval From—	Kilometres per hour.	Metres per second.	Miles per hour.
5 to 6 P. M.	0	0	0
6 7 P. M.	2.8	0.8	0
7 8 P. M.	5.2	1.4	1.7
8 9 P. M.	72.0	20.0	44.7
9 10 P. M.	79.2	22.0	49.2
10 11 P. M.	83.5	23.2	51.9
11 12 P. M.	80.7	22.4	50.1

"Thus, during the storm, the average velocity of the wind at the Berne Observatory was from 20 to 23 metres per second, (44.7 to 51.5 miles per hour,) while the velocity of translation of the gale itself was only from 12 to 14 metres per second, (26.8 to 31.3 miles per hour.) I see in the comparison of these figures evident proof of a relative movement in the phenomena itself, of a partial displacement of air in the middle of the great current of air which moved towards the northeast, and this intense movement could be only a turning movement. The storm of February 20th was then a cyclone, and the devasted zone was the *dangerous side.*"

[*Note of Mr. E. Nouel, from Comptes Rendus.*]

"In a note on the theory of hoar frost and *verglas*, (frozen rain,) printed in Vol. XI, (1863,) of the *Annuaire de la Société Météorologique de France*, page 26, I showed that the great verglas are not due, as is

believed, to a rain *above zero* [centigrade], partly freezing by contact with objects whose temperature is below zero, but that they arise from a rain several degrees *below zero* [C.], in liquid state, falling through air *below zero* [C.], and congeal upon the surface of objects, in a continuous manner, through the effect of the surrounding temperature.

"This theory has been twice strikingly confirmed this winter, at Vendome. 1st, During the night of January 7th and 8th, a storm accompanied by a rain of 23.5 millimetres (0.92 inches) of frozen water, and by a temperature varying between 0° and —1° centigrade, (32° and 30°.2 Fahrenheit,) caused a *verglas* of about 15 millimeters, (0.59 inches) in thickness, which greatly damaged the trees. 2nd, The 22nd and 23rd of January following, a rain which lasted 30 hours, scattered over a period of 40 hours, produced a coating of transparent ice which I estimated at 25 millimeters, (0.99 inch,) and the temperature of the air was on an average at —2° centigrade, (28.°4 Fahrenheit,) during all this time.

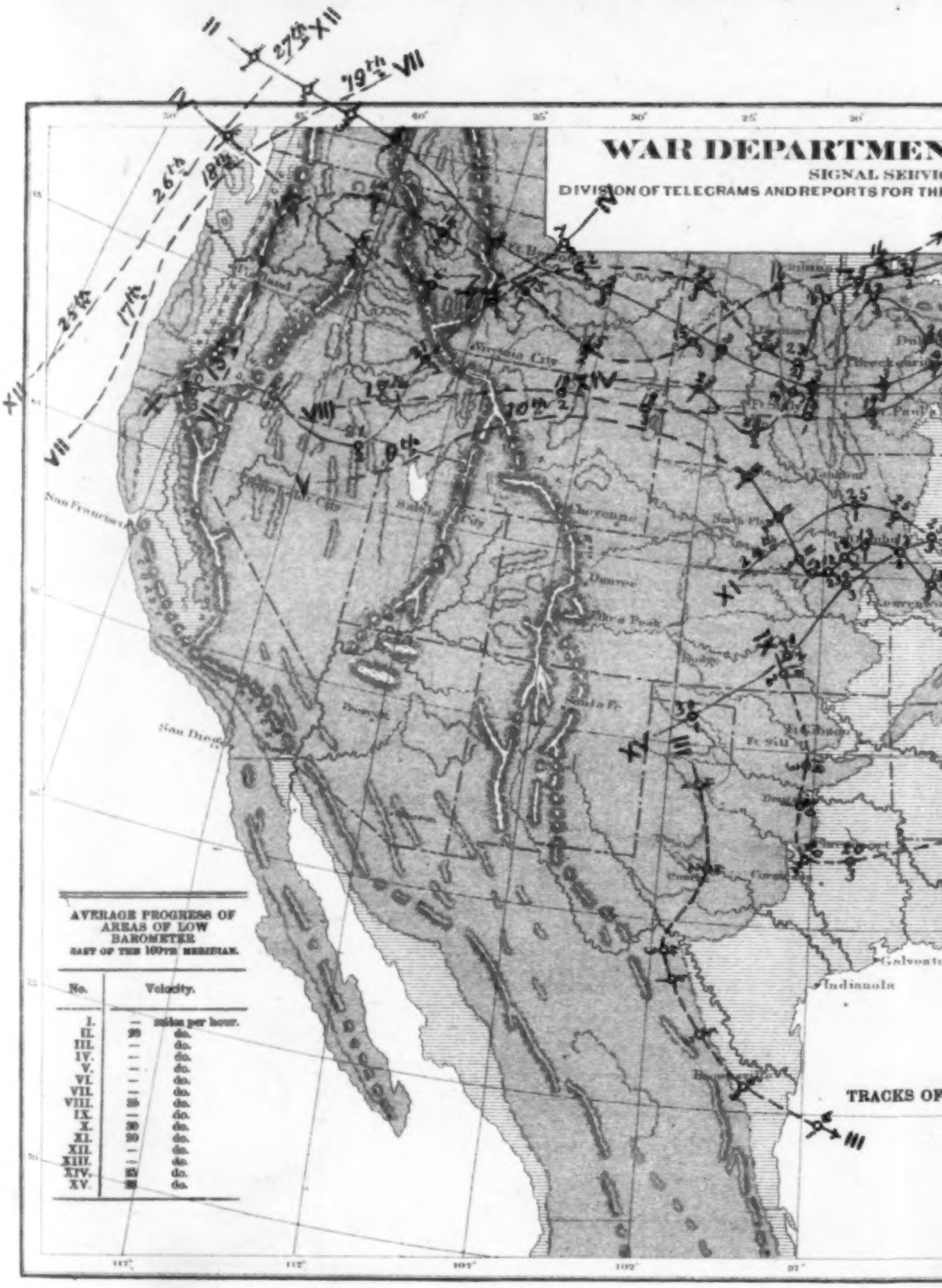
"Several observers have addressed to the Academy, (sessions of day January 27th and February 3rd,) notes on the great *verglas* of January 22nd and 23rd, Messrs. Nasse and Godefroy have joined thereto, (*Comptes Rendus* p. 192 and 244,) a theory as to its formation. This theory is only a reproduction of that which I had conceived on occasion of a like phenomena, December 25th, 1860, and which I published in the *Annuaire de la Société Météorologique* in 1863. It appears that it has remained unknown to physicists, whose attention has been awakened only this year by the exaggeration itself of the phenomena which has assumed proportions unheard of until now."

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

Brig. Gen. (Brt. Asstg.) Chief Signal Officer U. S. A.

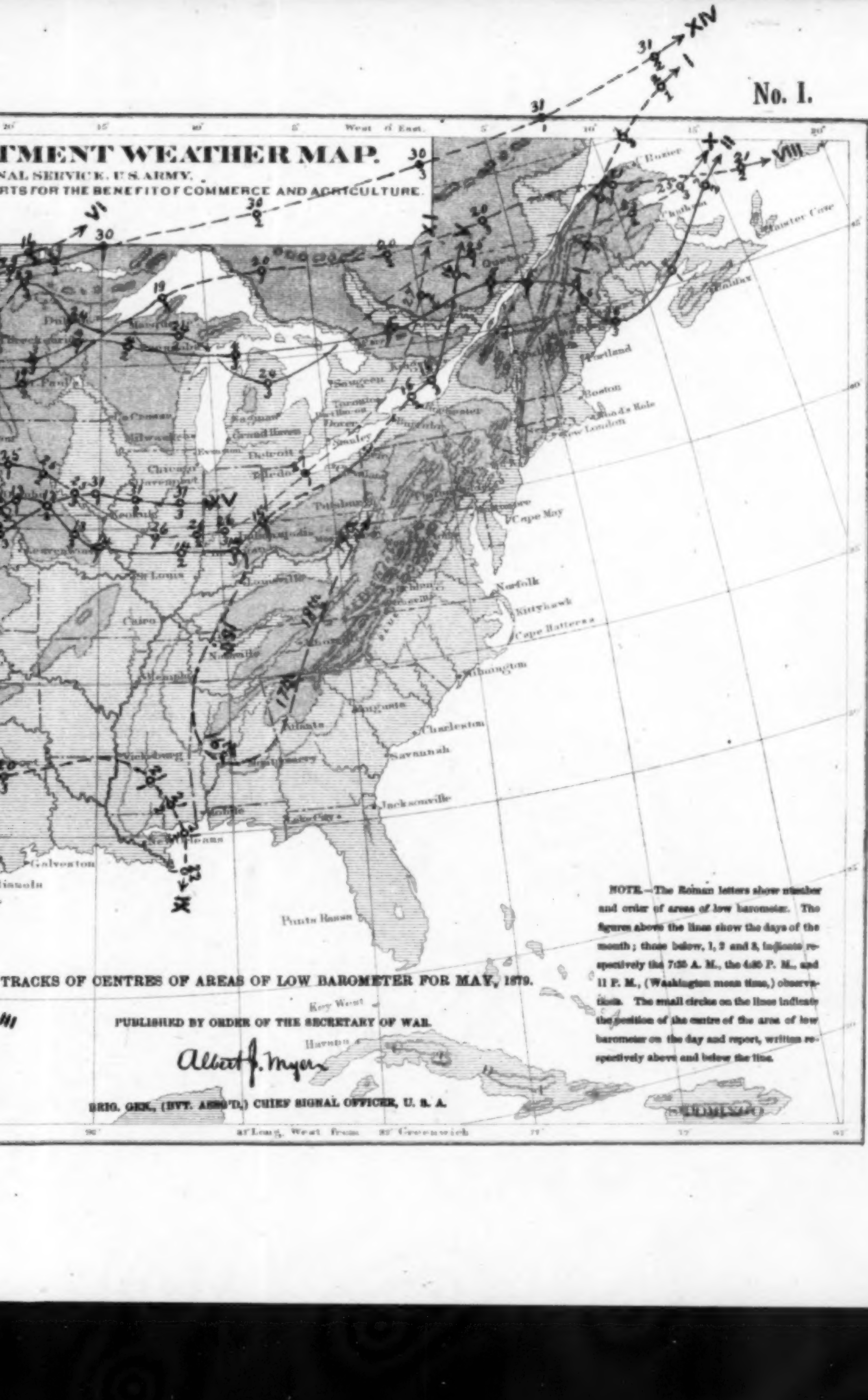
Copy furnished for



AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.

No.	Velocity.	
I.	—	miles per hour.
II.	[illegible]	do.
III.	—	do.
IV.	—	do.
V.	—	do.
VI.	—	do.
VII.	—	do.
VIII.	[illegible]	do.
IX.	—	do.
X.	[illegible]	do.
XI.	[illegible]	do.
XII.	—	do.
XIII.	—	do.
XIV.	[illegible]	do.
XV.	[illegible]	do.

No. 1.



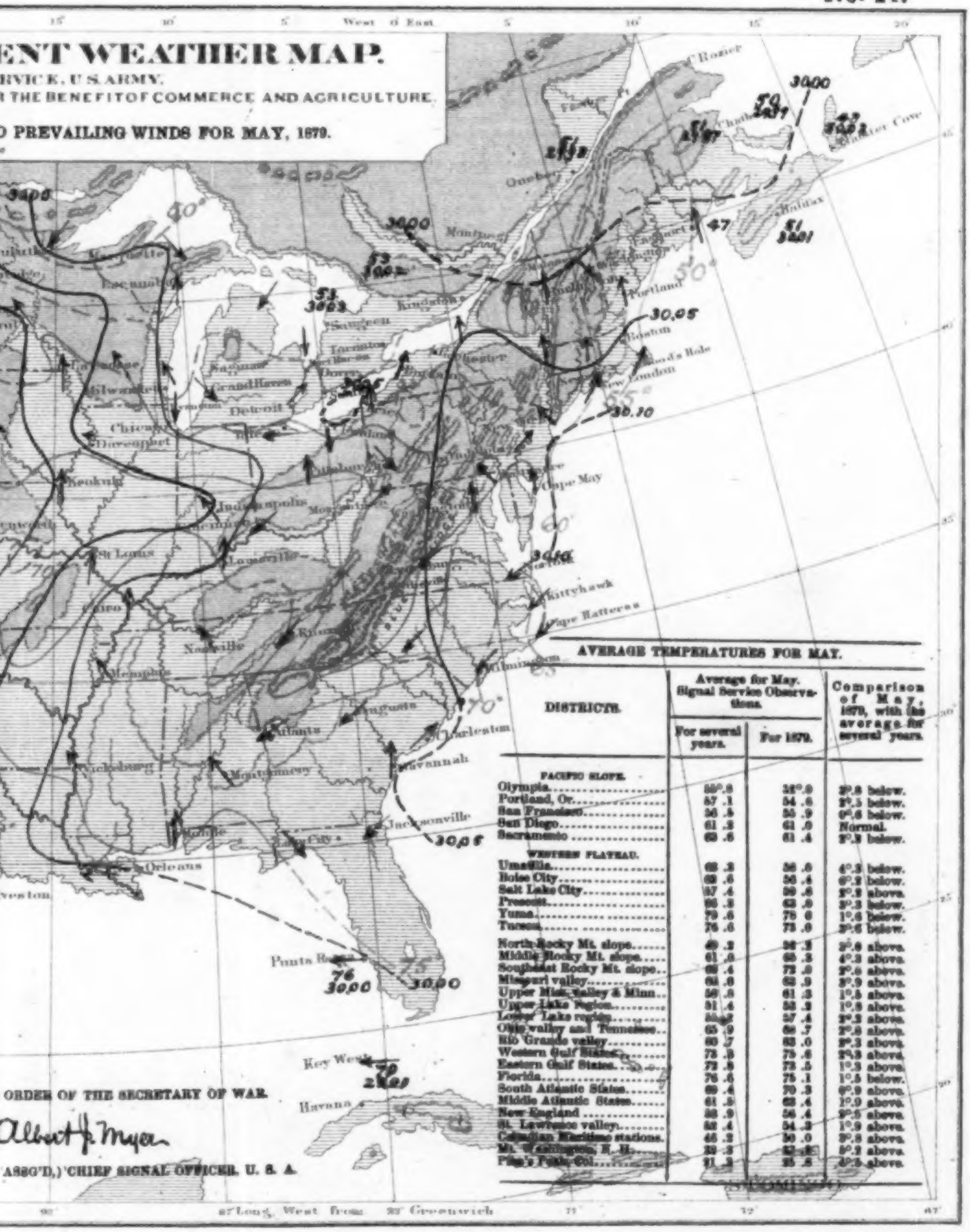
TMENT WEATHER MAP.
NAL SERVICE, U.S. ARMY.
RTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.
West 0 East
Portland
Boston
New London
Cape May
Norfolk
Kittyhawk
Cape Hatteras
Wilmington
Charleston
Savannah
Jacksonville
Galveston
Punta Rassa
Key West
Havana
Cairo
Chicago
Milwaukee
St Louis
Memphis
Vicksburg
Halifax
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR MAY, 1879.
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
BRIG. GEN., (BVT. ASS'D,) CHIEF SIGNAL OFFICER, U. S. A.
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.
Long. West from Greenwich

TEMPERATURES OF WATER FOR MAY, 1879.

STATIONS.	Temperature at bottom. Max.	Temperature at bottom. Min.	Average depth of water, in feet.
Alpena	65	46	[illegible]
*Augusta	85	73	[illegible]
Baltimore	77	56	[illegible]
Buffalo	59	34	14
Burlington, Vt.	55	38	[illegible]
Charleston	79	69	65
Chicago	59	48	6
*Cleveland	65	50	14
Detroit	61	49	20
Duluth	49	36	11
Eastport	41	37	15
Escanaba	56	36	15
Galveston	85	77	13
Grand Haven	69	25	18
Jacksonville	85	71	18
Key West	86	86	16
Marquette	48	36	15
*Milwaukee	51	46	15
Mobile	79	69	16
*New London	57	46	13
New York	64	49	16
Norfolk	77	61	22
Portland, Maine	51	42	25
Punta Rassa	85	77	13
Sandusky*	67	53.5	10
St. Marks	75	69	15
Savannah	90	79	11
Toledo	71	37	10
Wilmington	79	64	14½
Wood's Holl	59	46	8

* Observations for only part of month—see text.

No. II.



AVERAGE TEMPERATURES FOR MAY.

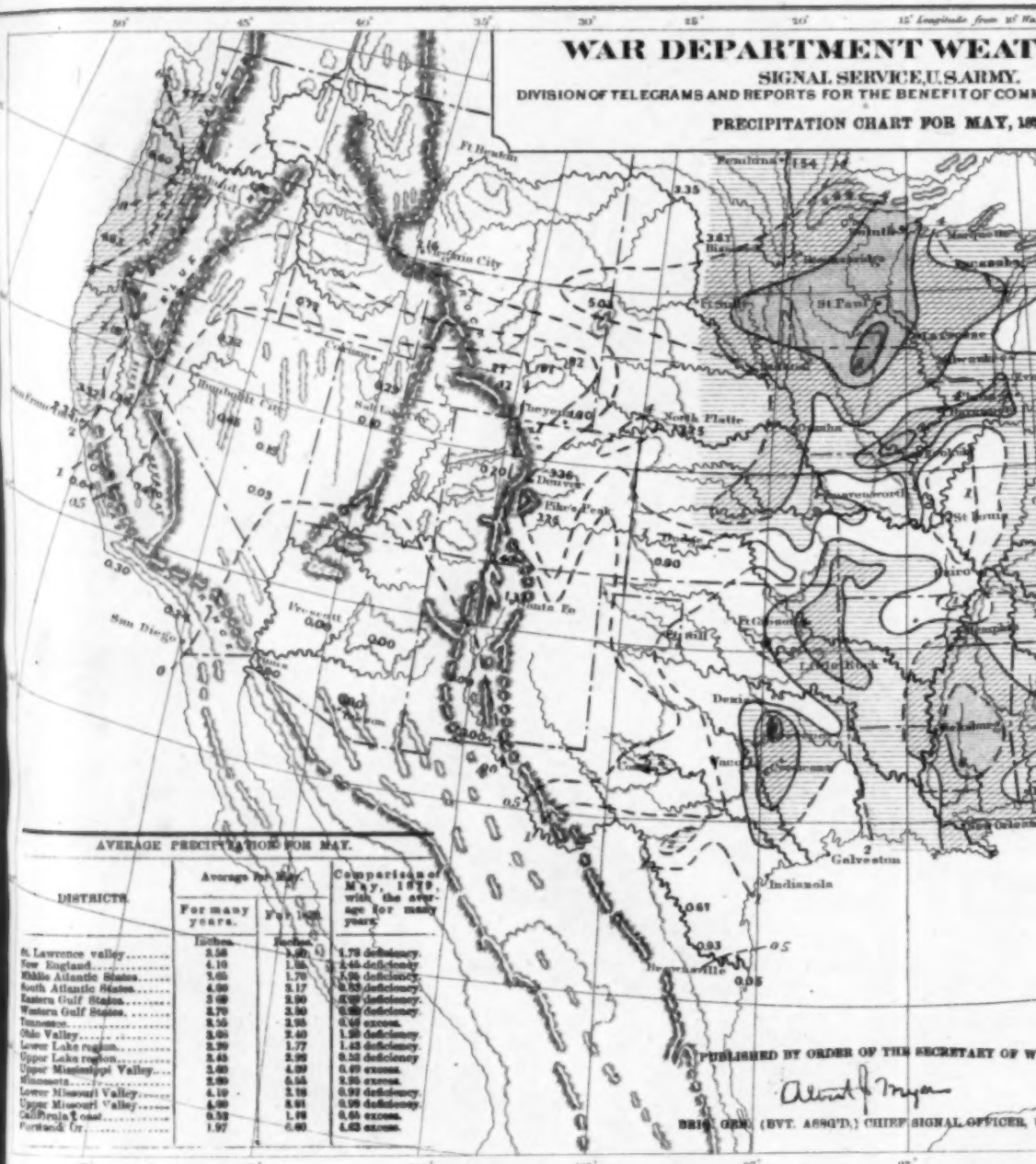
DISTRICTS.	Average for May. Signal Service Observations.		Comparison of May, 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE.			
Olympia	55°.8	52°.0	3°.8 below.
Portland, Or.	57 .1	54 .6	2°.5 below.
San Francisco	56 .5	55 .9	0°.6 below.
San Diego	61 .3	61 .0	Normal.
Sacramento	63 .6	61 .4	2°.2 below.
WESTERN PLATEAU.			
Umatilla	60 .3	56 .0	4°.3 below.
Boise City	62 .6	56 .4	6°.2 below.
Salt Lake City	57 .4	59 .6	2°.2 above.
Prescott	65 .3	62 .0	3°.3 below.
Yuma	79 .6	78 .0	1°.6 below.
Tucson	76 .6	73 .0	3°.6 below.
North Rocky Mt. slope	49 .2	52 .0	2°.8 above.
Middle Rocky Mt. slope	61 .0	65 .3	4°.3 above.
Southeast Rocky Mt. slope	69 .4	73 .0	3°.6 above.
Missouri valley	64 .0	67 .9	3°.9 above.
Upper Miss. valley & Minn.	59 .8	61 .3	1°.5 above.
Upper Lake region	51 .4	53 .2	1°.8 above.
Lower Lake region	[illegible]	57 .4	2°.3 above.
Ohio valley and Tennessee	65 .9	68 .7	2°.8 above.
Rio Grande valley	69 .7	72 .0	2°.3 above.
Western Gulf States	73 .3	75 .6	2°.3 above.
Eastern Gulf States	72 .2	73 .5	1°.3 above.
Florida	76 .6	75 .1	1°.5 below.
South Atlantic States	69 .4	70 .3	0°.9 above.
Middle Atlantic States	61 .5	63 .4	1°.9 above.
New England	53 .9	56 .4	2°.5 above.
St. Lawrence valley	52 .4	54 .3	1°.9 above.
Canadian Maritime stations	46 .2	50 .0	3°.8 above.
Mt. Washington, N. H.	33 .3	42 .5	9°.2 above.
Pike's Peak, Col.	31 .3	35 .6	4°.3 above.

WAR DEPARTMENT WEAT

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COM

PRECIPITATION CHART FOR MAY, 18



AVERAGE PRECIPITATION FOR MAY.

DISTRICTS.	Average for May. For many years.	Average for May. For 1879.	Comparison of May, 1879, with the average for many years.
	Inches.	Inches.	
St. Lawrence valley	3.58	1.80	1.78 deficiency.
New England	4.10	1.64	2.46 deficiency.
Middle Atlantic States	3.65	1.70	1.95 deficiency.
South Atlantic States	4.69	3.17	1.52 deficiency.
Eastern Gulf States	3.69	2.90	0.79 deficiency.
Western Gulf States	2.70	3.50	0.80 deficiency.
Tennessee	3.55	3.95	0.40 excess.
Ohio Valley	3.69	2.40	1.29 deficiency.
Lower Lake region	3.20	1.77	1.43 deficiency.
Upper Lake region	3.45	2.92	0.53 deficiency.
Upper Mississippi Valley	3.69	4.09	0.40 excess.
Minnesota	2.80	6.55	3.75 excess.
Lower Missouri Valley	4.10	3.18	0.92 deficiency.
Upper Missouri Valley	4.80	3.81	0.99 deficiency.
California coast	0.53	1.48	0.95 excess.
Portland, Or.	1.97	6.60	4.63 excess.

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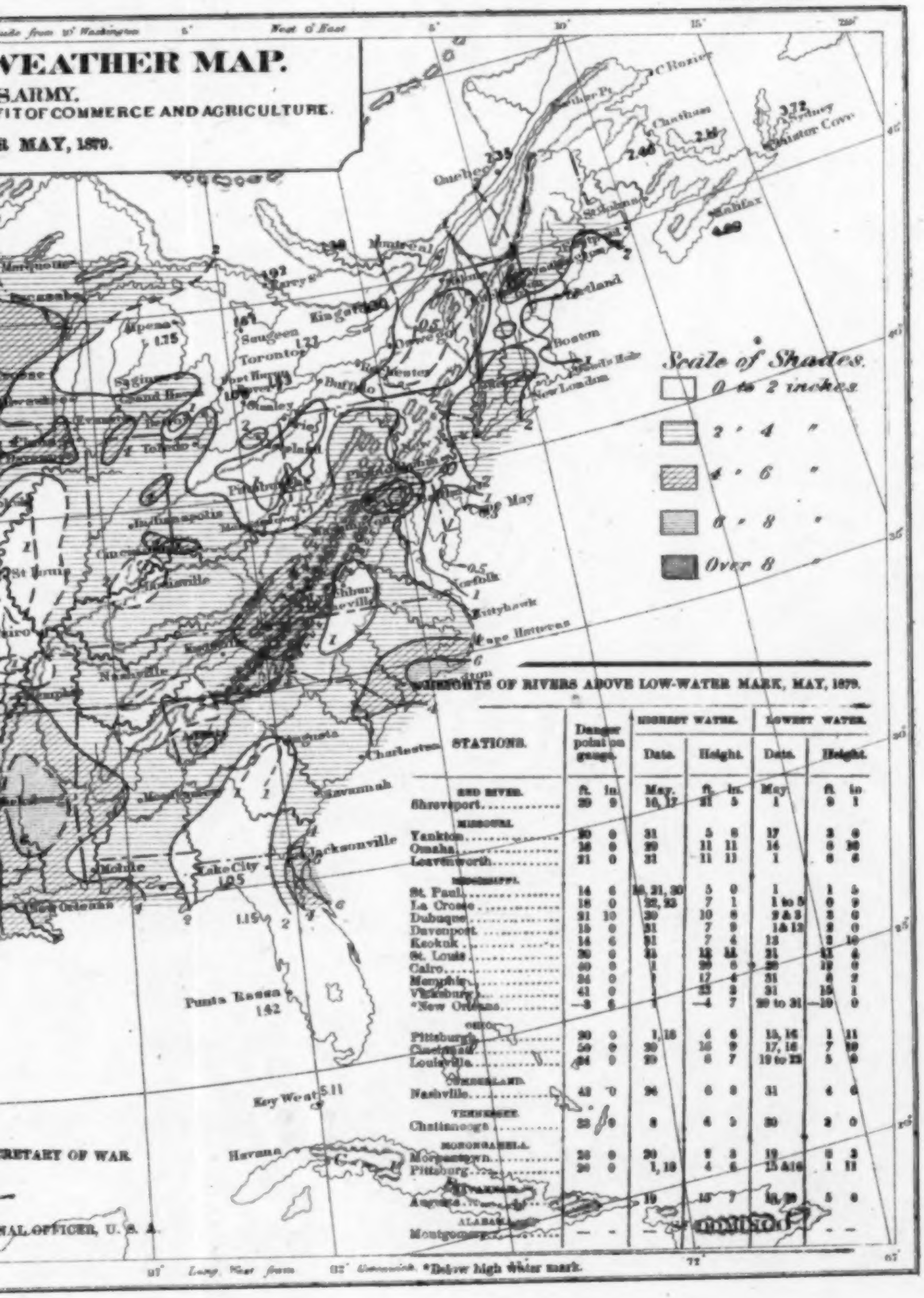
Albert J. Myer

BRIG. GEN. (BVT. ASS'T.) CHIEF SIGNAL OFFICER,

No. III.



HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, MAY, 1879.

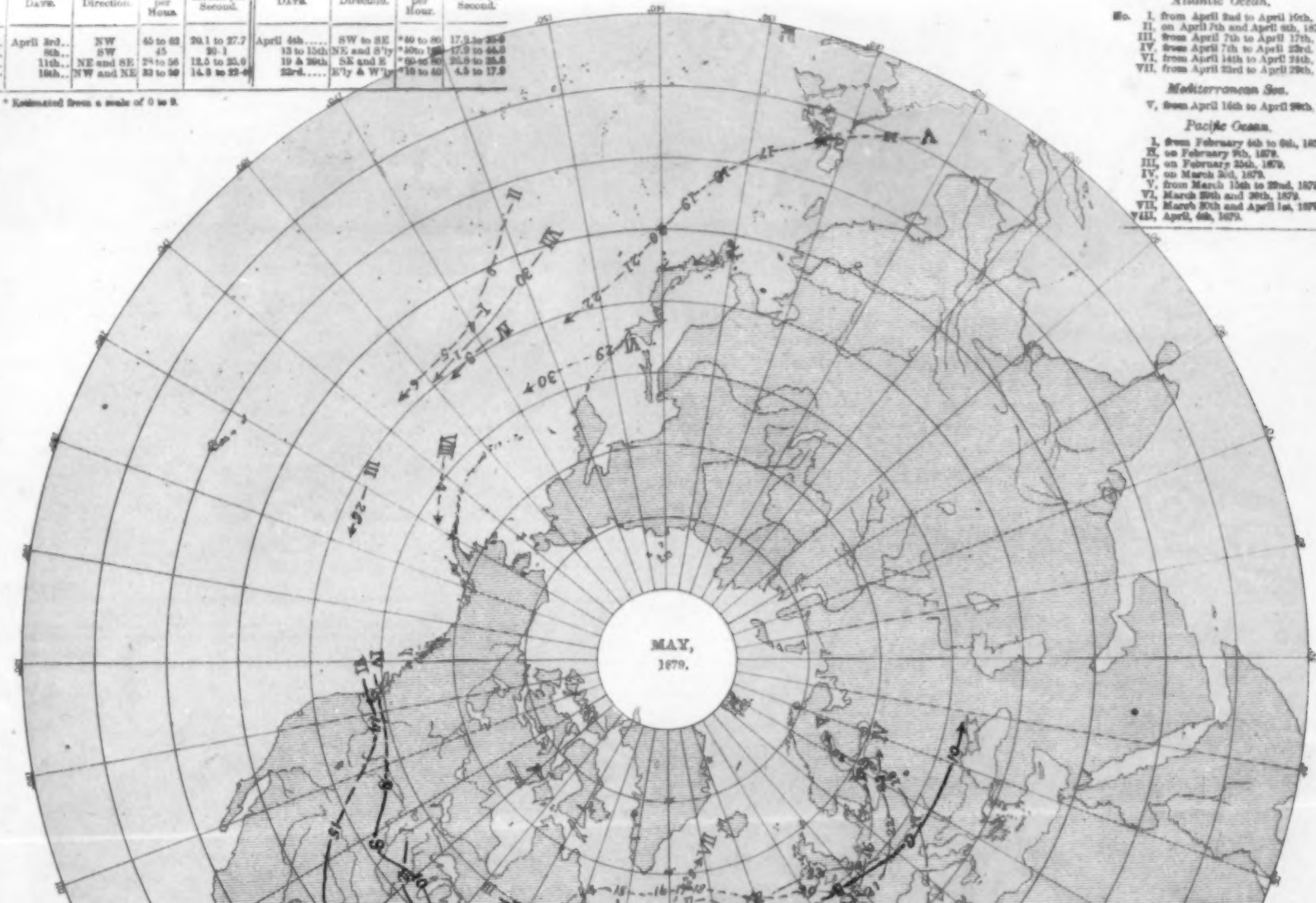
STATIONS.	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
RED RIVER.	ft.	in.	May.	ft.	in.	May.	ft.	in.
Shreveport	29	9	16, 17	31	5	1	9	1
MISSOURI.								
Yankton	20	0	31	5	8	17	3	6
Omaha	16	0	29	11	11	14	6	10
Leavenworth	21	0	31	11	11	1	8	6
MISSISSIPPI.								
St. Paul	14	6	18, 21, 30	5	0	1	1	5
La Crosse	18	0	22, 23	7	1	1 to 5	0	9
Dubuque	21	10	29	10	8	9 & 3	3	6
Davenport	15	0	31	7	9	1 & 12	2	0
Keokuk	14	6	31	7	4	13	2	10
St. Louis	30	0	31	13	11	21	11	4
Cairo	40	0	1	30	5	29	19	0
Memphis	34	0	1	17	4	31	6	7
Vicksburg	41	0	1	23	2	31	15	1
*New Orleans	—3	6	1	—4	7	29 to 31	—10	0
OHIO.								
Pittsburgh	20	0	1, 18	4	6	15, 16	1	11
Cincinnati	50	0	30	16	9	17, 18	7	10
Louisville	24	0	29	6	7	19 to 23	5	6
CUMBERLAND.								
Nashville	42	0	26	6	8	31	4	6
TENNESSEE.								
Chattanooga	23	0	8	4	5	30	2	0
MONONGAHELA.								
Morgantown	28	0	20	9	3	19	8	3
Pittsburg	20	0	1, 18	4	6	15 & 16	1	11
SAVANNAH.								
Augusta			19	15	7	18, 29	5	8
ALABAMA.								
Montgomery	—	—	—				—	—

*Below high water mark.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

	American Coast.				European Coast.			
	Date.	Direction.	Miles per Hour.	Meters per Second.	Date.	Direction.	Miles per Hour.	Meters per Second.
No. I.	April 3rd..	NW	45 to 62	20.1 to 27.7	April 6th.....	SW to SE	*40 to 80	17.9 to 35.8
III.	8th..	SW	45	20.1	13 to 15th	NE and S'ly	*40 to 80	17.9 to 44.6
IV.	11th..	NE and SE	78 to 56	12.5 to 25.0	19 & 20th	SE and E	*30 to 80	26.8 to 35.8
VI.	16th..	NW and NE	32 to 50	14.3 to 22.4	22rd.....	E'ly & W'ly	*10 to 40	4.5 to 17.9

* Estimated from a scale of 0 to 9.



INDEX TO STORM-TRACKS

Atlantic Ocean.

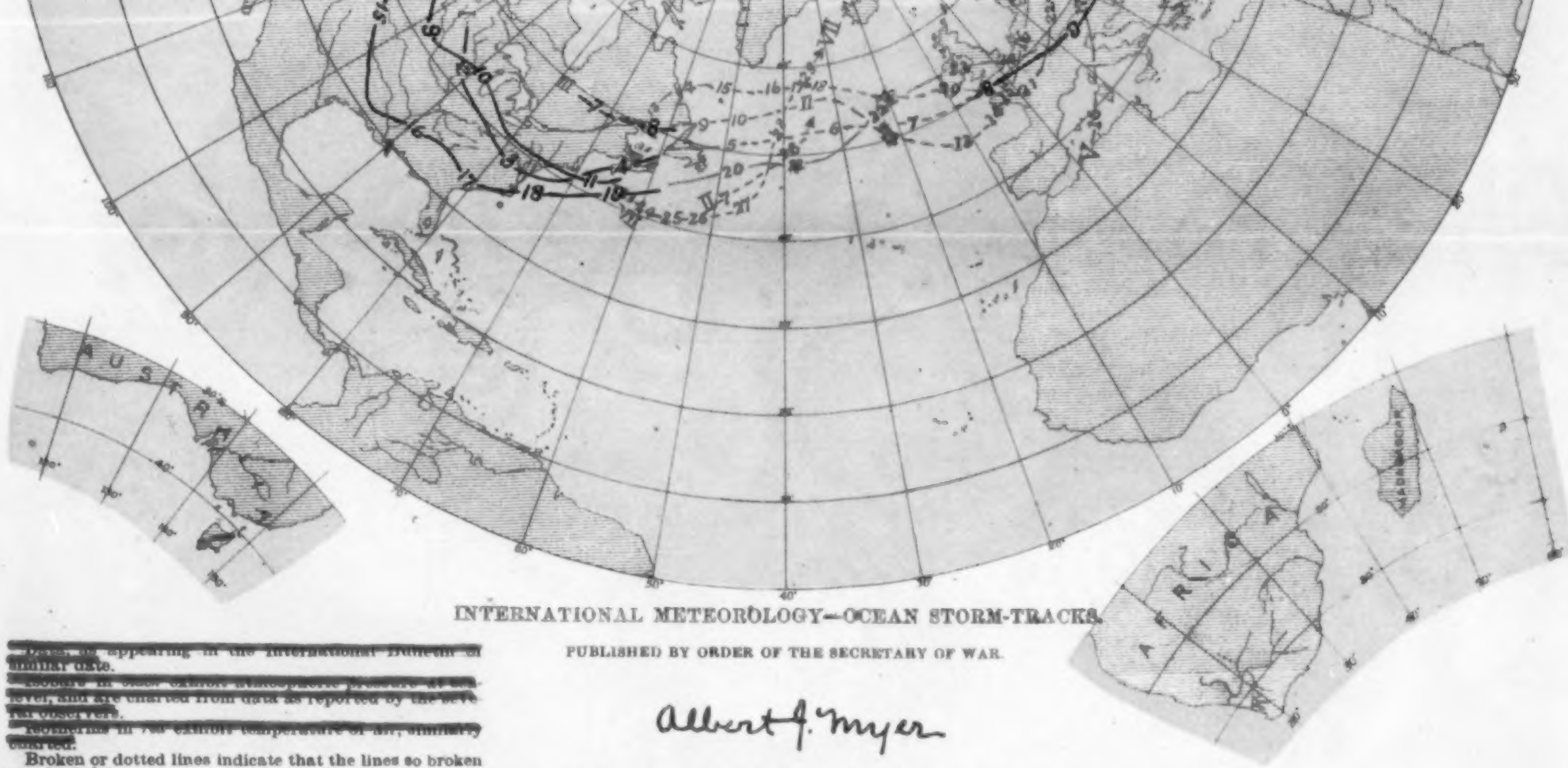
No. I. from April 2nd to April 16th, 1879.
II. on April 7th and April 8th, 1879.
III. from April 7th to April 17th, 1879.
IV. from April 7th to April 23rd, 1879.
VI. from April 14th to April 24th, 1879.
VII. from April 22nd to April 29th, 1879.

Mediterranean Sea.

V. from April 16th to April 28th, 1879.

Pacific Ocean.

I. from February 4th to 6th, 1879.
II. on February 9th, 1879.
III. on February 25th, 1879.
IV. on March 3rd, 1879.
V. from March 12th to 22nd, 1879.
VI. March 29th and 30th, 1879.
VII. March 30th and April 1st, 1879.
VIII. April, 4th, 1879.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

[redacted]

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction and force.

The tracks charted in black have appeared in previous *Reviews.*

The tracks charted in red have been made from data collected since preceding *Review.*

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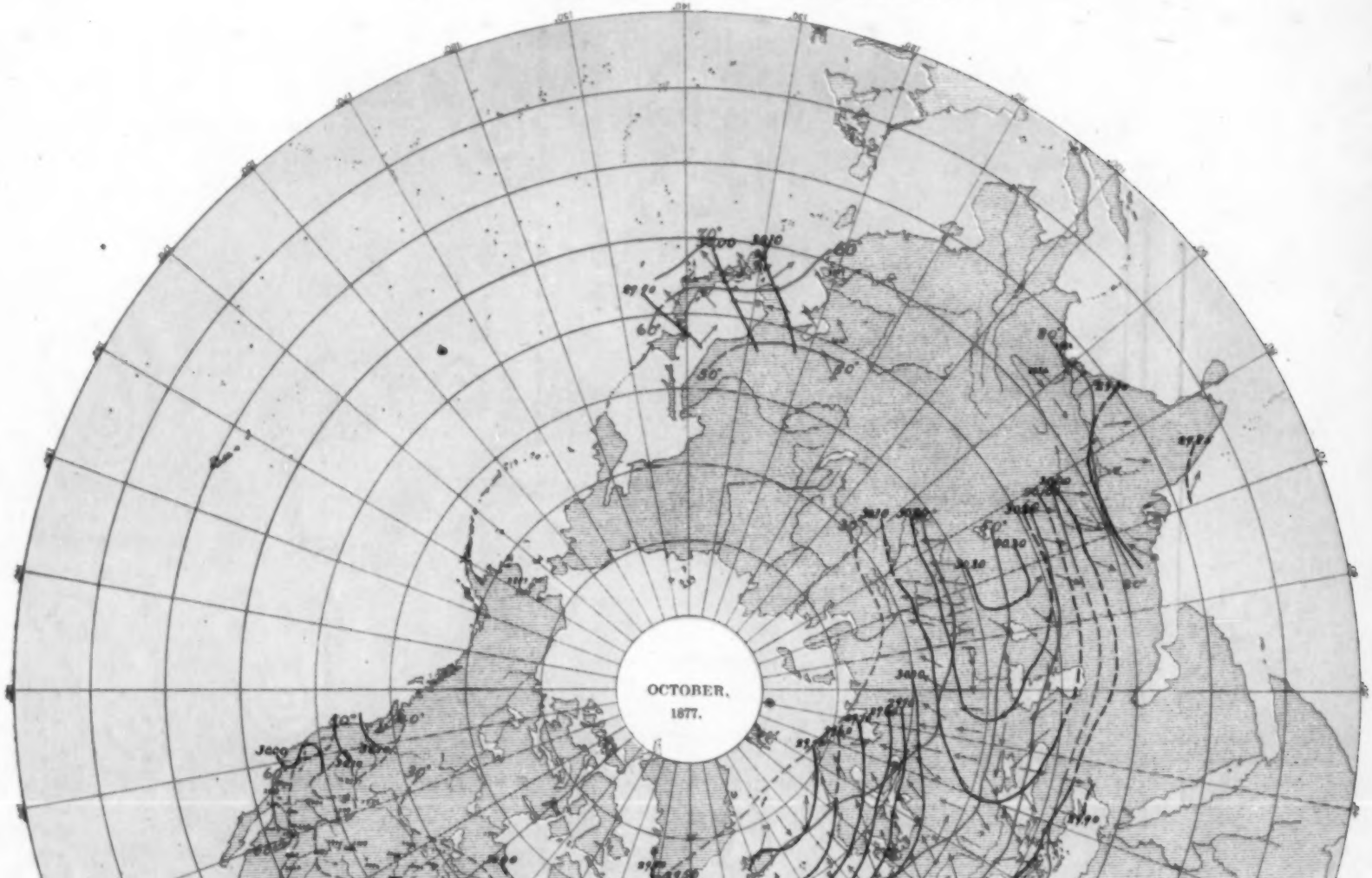
Albert J. Myer

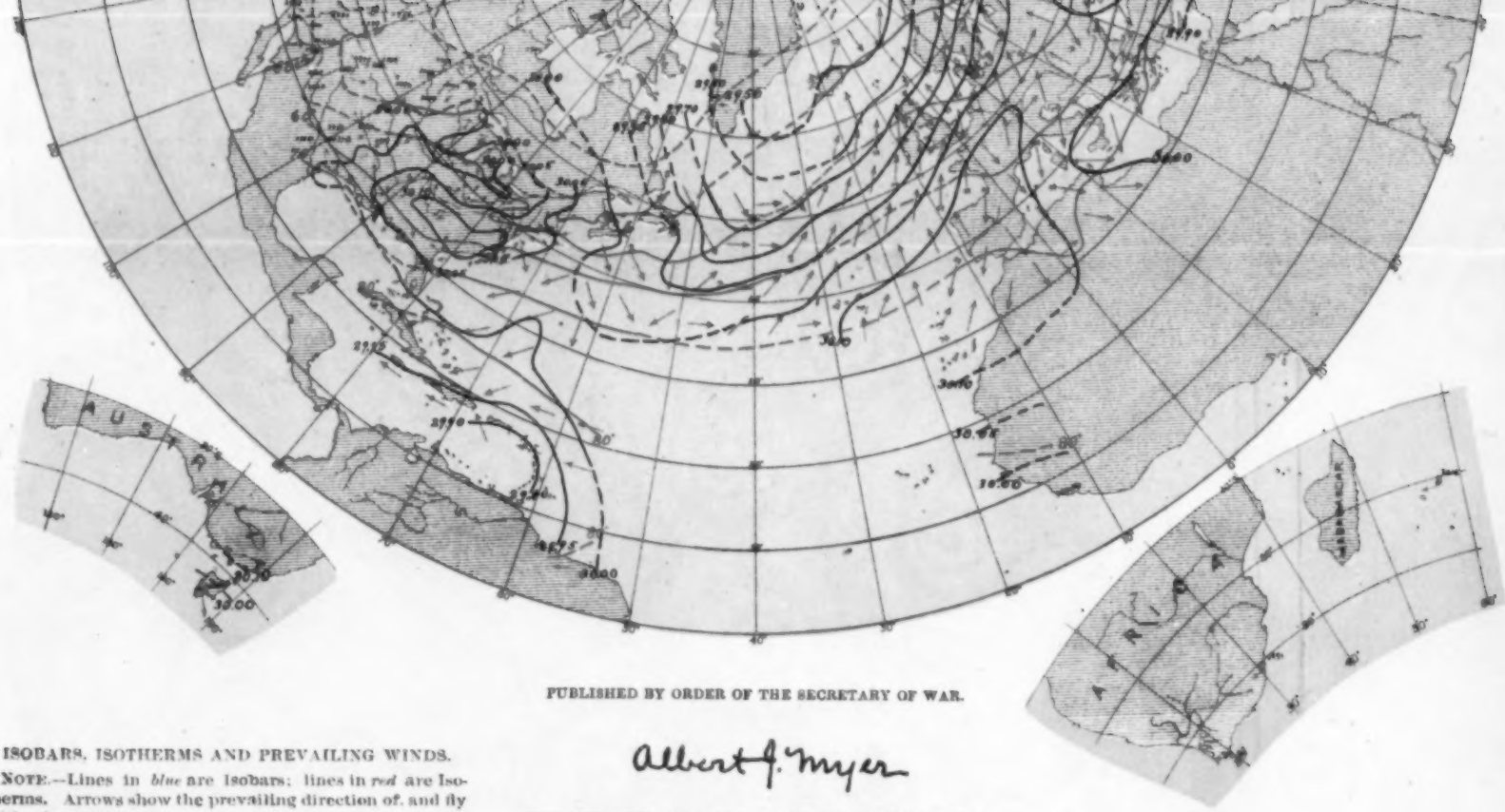
BRIG. GEN., (BVT. ASSG'D,) CHIEF SIGNAL OFFICER, U. S. A.

The Heliotype Printing Co. 220 Devonshire St. Boston

INTERNATIONAL MONTHLY CHART,

Showing mean pressure, mean temperature and prevailing direction of winds for the month of October, 1877, based upon the daily charts of the International Bulletin.





ISOBARS, ISOTHERMS AND PREVAILING WINDS.

NOTE.—Lines in *blue* are Isobars; lines in *red* are Isotherms. Arrows show the prevailing direction of, and fly with, the wind.

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